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SEED GERMINATION TEST USING IMAGE PROCESSING

Angelina Gill[1], Jatindar Singh[2]*
[1]Deptt. of Computer Application, Lovely Professional University, Jalandhar, Punjab, India
[2]Deptt. of Horticulture Lovely Professional University, Jalandhar, Punjab, India
*Corresponding author Email: jatinder.19305@lpu.co.in

Abstract

Recently many technologies and processes tend to be specific and autonomous. It has been trying hard to bring various kinds of technologies especially agriculture related, to a qualitatively new level. Precision agriculture is the best example in which soil and other sources are used very efficiently and intelligently. In this type of agriculture various kinds of sensor technologies like application of nutrient and irrigation, pesticide, soil sensing, measuring, yield mapping, and robotic harvesting, etc. As computer power in becoming popular in every field, it has also become possible to make use of open source libraries to amalgamate complex signal processing approach, recognition of object and machine learning methods into well-established applications. Because of these aspects, a situation may be thought where designs of plant inspection and harvesting with the help of robotic solutions can emerge, is possible. This review provides the insights regarding use of various sensors about test of seed germination before actual field cultivation.

***Keywords*:** Germination, Sensor, Computerized, Image processing

Introduction

The purpose of this review is to present the, seed germination, seed technology and vigor methods through image processing. Computer–aided image study techniques have been used to observe development and strength of the seed and image processing and techniques have been used for increasing seed quality tests (Chaugule, 2012). Computer vision is premeditated to discriminate seed germination under controlled conditions. Both Image acquisition and image analysis are utilized for picture skeletonization and picture preparing calculations. Seed territory and length changes can be distinguishing after the changing seed picture into binary. Computer vision methods are thought to be continuous procedure for seed testing. Computer-aided techniques helped frameworks created by the specialists for assessing seed germination rate length increments. Digital camera and flat-bed scanner are commonly used for acquire seed images. Counting and evaluation of germinated seeds image are accomplished through morphology operations as well as fuzzy logic techniques. Germination and non-germinated seeds may be observe and distinguished by computer vision. These conclusions may be utilized for testing germination of the seed. These may aid the concerned industry and researchers for enhancing their skill in seed testing and quality assessment (Raheja *et al.* (2011).

Various procedures for seed quality assessment and arranging depend on the uncovering of different physical and physiological seed attributes. Image processing has a low cost, high speed, ability of computer hardware controlled environmental condition system has prepared computer vision is more useful for examination of crop seed. The machine image is suitable in a seed biology laboratory as suggested by image analysis software tools, new technique and their hardware design. Computer–aided image analysis techniques is recent develop technology for monitoring seed imbibitions. The test of germination is requisite to depict the germination ability of a seed with high precision methods. To determine timing of radicle emergence used image recording, increase of area and roundness factor and to various germination conditions and different temperature to deteriorated seeds. (Dell'Aquila, 2004). Computer-aided image analysis plays an important role of seed morphology and biology. Monitoring, quality and cataloging of seed based on size, shape, and color through imaging technology. The importance of machine vision systems for observing and categorization of plant products is the ability to observe an image exactly and fast. CCD-camera, flat bed scanner, X-ray scanning, or NMR imaging are used to get images of seed presentation outer or inner characters of certain value factors. Seed quality evaluation and sorting are based on the detection of different objective properties of seeds used different types of techniques and producing sophisticated non-destructive methods is also focused. Image processing controlled environmental situation and made computer vision more useful for observation of crop seeds (Dell'Aquila, 2006). In this review, discussion about the digital imaging and information technology used for testing seed germination ability. This innovation is checked on considering ongoing passion on the advancement and reception of economical agro frameworks got together with a cutting edge technique of "accuracy farming", Assimilating seed execution are depicted with the target of showing the capability of this procedure to be satisfactory for beating issues with a standard seed germination test. Imaging has the possibility to make a decision about the two-dimensional seed surface. Thickness of RGB spectrum can be used as marker for testing the starting the seed germination in lentil. The simplest techniques, the accessibility of high-speed data and processing technology has encountered a transformed curiosity among the researchers. Recent designs of machine vision systems are models required greatly computerized with the execution of modern algorithms (Dell'Aquila, 2009).

Manual Germination test

Germination test can be defined as a measure of the capability of seeds to germinate, production of seedling and ultimate plant. For germination test, 400 pure seeds are taken-in replicates of 4. The seeds are sown under favorable conditions like optimum moisture, temperature and others if

any special requirement is there. During this test days taken for germination are also observed.

Purpose of Seed Germination test

Such calculation is compulsory to accomplish the succeeding purposes for diminishing the hazards of imbedding less eminence seeds.

1. To evaluate seed suitability for planting
2. To categorize the quality related problem and solution
3. To govern drying requirement and processing and related specific procedures for future use
4. To govern weather seeds meets quality standards that are specified on the label.
5. To provide a basis for fixing the price. The prime objective of the seed test approach is to acquire precise and reproducible outcomes concerning eminence grade of the seed sample lots acquiesced to Seed Testing Lab.

Importance of Seed Germination test

- Seed testing significance was comprehended more than 100 years (approximately) ago for definite planting values including production etc. The contamination of vegetable seeds by stone dust which was noted in some regions of the world.
- Seed evaluation test has been considered as an aid for cultivation of crop as it helps to prevent some serious diseases like seed borne and also helps to explore various quality attributes of the same like moisture content, purity level, germination percentage, vigour and health parameter.
- There are various protocols of seed testing which decide the truthfulness of the seed. And it a major contributing factor in quality control process.
- Seed testing process is mandatory to estimate planting worth of the same.
- In seed industry this test is necessary so that quality attributes of the seed lot can be explored
- These characteristics are moisture, vigour, probable germination, genetic and physical seed cleanliness, free from insect infestation and various seed diseases. In our country, India, testing of seed is carried out primarily for moisture per centage, germination count and physical cleanliness of the seeds to be sown.
- In field of seed testing standard procedures were set by International Seed Testing Association institution. It is mandatory to follow the rules set by 1STA, 1985 if the same is to be marketed in International trade.
- These seed testing techniques are designated, based on the international rules as maximum rules are based on, 1STA, 1996 (International Seed Testing Association). Economic produce of a crop depends on the seed excellence which can be evaluated by 1STA, 1996.
- Testing Seed especially seed quality is carried out on seed samples procured from seed lot, which are to be used for field cultivation. Drawn sample is minute in size and represents the whole seed lot from where it is drawn.

Seed certification and quality regulation programmes, seed testing laboratories are especially meant for seed certification and quality control. The foremost aim of such labs to assist the producer, and grower by offering info regarding quality and other aspect of the seed. To continue homogeneity in regulation of seed quality the seed analysis laboratory can be differentiated into different segments for instance purity testing section, testing cleanliness evaluation of cultivar geneuiness, moisture testing segment and germination testing segment.

Working of Lab

First of all, submitted sample are compacted first to acquire working samples for evaluation of different tests. For this purpose, various methods are implemented for procurement of working samples.

Mixing cum separation of seeds

The prime objective of mixing and dividing is to obtain the demonstrative standardized seed sample for investigation by declining the acquiesced seed sample to the anticipated size of working sample.

Technique of mixing and dividing

- Mechanically distribution of the seeds
- Altered splitting process
- Hand splitting technique
- Random cup approach
- Spoon process

Evaluation of Seed Germination tests is as follows:

(1) Number of seedlings (normal in growth) is observed. It is supposed that normal seedlings will result in normal plant they must possess morphological and physiological as like full plants.

(2) Number of abnormal seedlings or which shows too much or very less growth. Simply we can draw inference that due to morphological or physiological reasons are they are incompetent and are unable to producing normal plants.

(3) Seeds which are unable to initiate germination process are counted.

After sowing the seeds all these observations are noted and are traditionally reported in terms of per cent germination with following details

1. % age of normal seedlings
2. % age of non-germinated seeds

Procedure of germination test (Tetrazolium test)

1. Soak the seeds sample (approximately 100 seeds in replica of 3 in 1 ml scarification solution for duration of 15 minutes and shake the solution under room temperature conditions. After that wash the seed samples 3-4 times to wash away the bleach solution.
2. Then incubate the seed sample with Tetrazolium solution @1% at 30 °C for 1 to 2 days (24 to 48 h) in dark conditions. Sometimes reddish coloured spots or staining appears too early. But watch the seeds after time period of 24 h and If staining occurs then 3rd step should be continued
3. After staining, distilled water should be use for washing the seeds.
4. Stained seeds should be dipped in clearing agent for period of 1-2 h.

   Trail step no. 4, if the pigment over the seed coat averts clear vision after staining.
5. Stereo microscope may be used to observe the seeds.

6. Assess the seeds on the base of staining. Among processed seed sample, seeds with bright red coloured, are supposed to be entirely viable while moderately coloured seeds may lead to gemination of normal seedlings with irregular growth. Greyish red or pink colour specifies dead tissue. Seeds which remain non-stained are non-viable.
7. Simultaneously, 100 seeds are placed in two layers of filter paper (Whatman no.1) soaked with distilled water under lab conditions (seeds scarification).

Always perform the test in triplicate. To score this germination process, protuberance of radicle can be considered as positive result. Results can be acquired as percentage germination. It can be calculated as following-

$$= \frac{\text{No of germinated seeds}}{\text{Seed Number in taken sample}} \times 100$$

Image processing and machine learning techniques is possible through Computer vision system. For creating complete system there are several applications image, WEKA and public JAVA classes as well as specially developed code used. Low-priced commercial software was used for quality of seed, evaluation and discovery of a range of specific germination parameters. Presently, seed testing is evaluated in recognized laboratories by qualified technicians. A number of tests are completed under the rules of the ISTA and tests are planned to assess seeds under suitable. A good hardware and superior software using low level programming language then time can be reduced and better result in seed germination test (Chaugule, 2012). Agricultural products seeds plants are very important and seed quality is important for the quality and quantity of the plant crops. Specific sowing properties like purity, authenticity, infections, humidity, vitality, germination vigor are the basis of good quality of seed. The variety of the seed value effect and their problems in quantitative/qualitative evaluation makes the superiority evaluation procedures significantly difficult. It is not change for year but a large part of existing seed quality assessment technologies and Initial tools. The direction for the development is for new technologies and for good crop of seed. One of basis technologies in this called computer vision. Seed quality factor is a large part for evaluated through the specialist on grounds of verities of exits component (Mladenov *et al.,* 2008).

Agriculture's most important part is seed by which control the value and yield of its production. The good quality of seeds is important for pesticides, water and fertilizers. So, it is compulsory to improve the quality of seed for definitely the high efficiency, quality and productivity of agriculture production. Seed quality can be measured through seed vigor it is an index of seed quality. Seed strength testing is a detailed method of determining the value of seed verity. The survey depicts of diverse machine vision techniques and about seed quality evaluation. The accessibility of suitable software tools for image analysis suggests use of machine vision in the seed biology laboratory is appropriate (Belsare & Dewasthale, 2013).

Smart phones are useful equipment for agriculture as its mobility matches the environment of farming, cost is not much high and many of practical application has been produced. Furthermost various types of physical sensors also make them a capable device to help miscellaneous farming work. In this paper reported that smart phones applications are involved in research literature and develop smart phone incorporated sensors to give agricultural solutions. Most important tools are GPS and cameras which are used for reviewed papers. In the past few decades smart phones have got significant achievement in many fields due to its facility for instance helpfulness, user-friendliness, and affordability. Approximately the numbers of users are more than 2 billion people worldwide. Positioning sensors, cameras microphones and motion sensors are some of sensors which is included in smart phones and make it ability secure. It is used by many industrial also for their work smoothness and easy as it used in health care and education (Pongnumkul *et al.*, 2015).

For quality evaluation problems resolving various types of designs has been emerged with spectroscopy and imaging technologies, spectral imaging modalities. Special multivariate chemometric study scenario has been productively implemented food quality and safety control purposes, as well as different challenges faced in seed science and technology dealing. In this review has been describes the basic design of the systems and give a small size analysis of current approaches. Imitation of images for a quality seed, evaluation and concentrate on only evaluation of special sorts of seeds. So, the main research dedicated to real implementations of only fully-operated multispectral imaging systems and not implemented of key wavelengths take out from hyperspectral data without structure autonomous (ElMasry *et al*., 2019).

In this review to study the effect of salt stress on seed germination by using optical coherence tomography for this experiment and conduct with variance molar concentrations of NaCl. The seed were monitored to establish the optimal focus for the seed growth in nine consecutive days. The images of seeds that were developed using sterile distilled water before treatment. The seeds were analyzed with the help of vivo two-dimensional OCT images. Germination of seeds is a increase procedure when the plant is contained within its seed. Generally, strength of profile study was utilized to help the result. Variety of inside factors and external can be affected germination (Ravichandran *et al*., 2017).

Conclusion and Future Scope

Some agricultural practices like detection, gripping and picking of the fruit, are some of the common examples of robotic harvesting. Mentioned tasked were accomplished by using multi sensors. Leanings in robotic type harvesting exhibits that multi-sensor provisions would afford further summarized data for harvesting process where 3D type of instruments, sensors like LIDAR, laser range finder or TOF can expressively improve accuracy of fruit localization and recognition. Likewise, provision of multiple instruments offers more chances for assessing the ripening process, gripping and selection of the same as desired. Several quality measurements before harvesting the fruit may be attained using 3D chemical sensors including with computer vision. Processing of obtained data from sensor, in tangible time is one of the prime tasks for additional research principally for composite provisions with manifold sensors. Supplementary development and research are mandatory to launch the commercial and technical possibility concerning seed quality. Regardless of conceivable hopes and extensive research there are yet no commercially accessible nor composite or sole

task-oriented resolutions for this kind of computerized approaches.

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