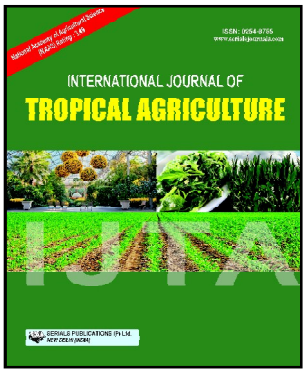

INTERNATIONAL JOURNAL OF TROPICAL AGRICULTURE

ISSN : 0254-8755

available at http: www. serialsjournals. com

Volume 36 • Number 4 • 2018

Characterization of Soybean (Glycine max L. Merrill) varieties Through Image Analysis

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Abstract: Varietal identification or discrimination of cultivars is essential for quality seed production. The measurement of geometry of single seed is possible with image analysis technique. Image analysis is an attractive system easily employed in many environments, non destructive, give a realtime analysis and inexpensive. Variation in seed morphology was observed for all the genotypes studied using image analyzer.

In the view of this, a field experiment was conducted at Post Graduate Institute, Research Farm, Department of Agricultural Botany, Mahatma PhuleKrushiVidyapeeth, Rahuri, during summer season of 2014. The laboratory studies were undertaken at seed technology Research Unit, Mahatma PhuleKrushiVidyapeeth, Rahuri. For this purpose seeds of 14 different soybean varieties (Table 1) were used. Seed morphometric character viz. Seed length(mm), seed width(mm), seed volume(mm^3), seed surface area (mm), seed roundness were recorded employing DeltaT(c) image analysis system with a win 'DIAS' software. Three replication of 20 seeds were used for recording the measurements.

Key words: Seed geometry, image analyzer, machine vision, cultivar identity

INTRODUCTION

Image analysis technique (machine vision system) is one of such systems offers the prospect that researchers will be able to study seed surface features more closely and hence increase the available character set. Thus it has potential use in a wide range of tasks such as determining the cultivar identity of seed lots and testing of the distinctness of new cultivars for the award of breeders' right and cultivar registration (Keefe and Draper, 1986). Machine vision has been utilized for cultivar description, characterization and identification of varieties using

seeds and plant parts (Draper and Travis, 1984~ Van de Vooren*et al*., 1991) measured pod length and width using image analyzer and compared with manual measurement in French bean. Image analysis system was used by Aquila *et al*. (2000) to measure area, perimeter and length of white cabbage seeds in order to monitor changes in seed physical parameters during imbibition and suggested that image analysis techniques have high potential in seed biology studies. The image analysis technique can be used to analyze other planktonic classes (Blackburn *et al*., 1998).

MATERIALS AND METHODS

The soybean varieties were obtained from Agricultural Research station, KasbeDigras, Sangli. With a view to realize the objectives enumerated in the introduction chapter, the laboratory experiments were carried out in the Department of Agricultural Botany, Mahatma Phule Krushi Vidyapeeth Rahuri between 2012 to 2014. The experimental details and methods adopted are enumerated hereunder.

Measurement of geometry of seed using image analysis technique: The genetically pure seeds of the above varieties of mustard were subjected to image analysis technique with three replication having twenty five seeds each. The methodology and the parameters studied are described below.

Image analysis system: Image analysis was carried out using DeltaT © (Delta Instrument Device Cambridge, UK) image analysis system by running custom written software win DIAS (Webb and Jekins, 2000).

For every replication twenty five seeds were placed on lighting hood in such a way that embryo axis of seed facing image analysis system and longitudinal axis of the seed running parallel to the surface of the camera lens. Seeds were viewed with video camera (DSP surveillance colour CCD camera CVS 200/3300) using transmitted light, so that a binary image of the silhouette of the seed was recorded by the 2 WinDIAS2 . The image of the support was removed by software after image grabbing in the computer that leaves an image of the object consist five rows and five columns for geometric data measurement.

Data measurement: Before going to actual measurement, calibration was done by placing transparent plastic rule on the lighting hood illuminated from below. Rule was aligned diagonally across the field of view and focus was adjusted to sharpen the image. Again, aperture adjustment was done until optimum colour and contrast was achieved. Input length was given in centimeter.

To measure description like area, perimeter, length and width from the menu object meter was selected. After setting the image was grabbed using image grabber and colour threshold was done until the entire area was highlighted. By logging the data, click the measurement bottom, the entire data were extracted by every time clicking entire objects. Data were viewed from the review and mean data for each parameter were summed up for average value in the win DIAS itself. The entire image and data were saved in the document file and interpreted data results were reported.

RESULTS AND DISCUSSION

The seed length varied among soybean varieties (Table 1). According to seed length varieties were classified into three categories viz., short (<5mm), Medium (5-6mm) and long (>6 mm). The mean seed length was 5.09 mm. significantly highest seed length was observed in the variety PhuleKalyani (5.48 mm) and lowest was observed in the variety Bragg (4.59 mm). Among the 14 varieties five varieties had short and nine varieties had medium seed length. Similar classification was used for identification of sunflower genotypes by LaxmipriyaSahoo, *et al*. (2000).

According to seed width varieties were classified into three categories viz., short (<4 mm), Medium

Table 1
Identification and grouping of Soybean varieties based on seed morphometric characters

Varieties	*Seed length (mm)*	*Groups*	*Seed width (mm)*	*Groups*	*Seed volume (mm^3)*	*Groups*	*Seed surface area (mm)*	*Groups*	*Seed Roundness*	*Groups*
MAUS-71	4.92	Short	4.02	Medium	43.67	Small	52.13	Small	90.82	Spherical
KDS-344	5.32	Medium	3.93	Short	45.80	Small	54.98	Small	91.72	Spherical
KDS-378	5.41	Medium	4.08	Medium	47.75	Small	55.10	Small	90.46	Spherical
NRC-94	5.05	Medium	3.75	Short	58.23	Small	48.60	Small	87.98	Elliptical
KDS-722	4.61	Short	3.79	Short	56.80	Small	53.80	Small	90.43	Spherical
KDS-726	5.29	Medium	4.42	Medium	60.27	Medium	64.67	Medium	92.93	Spherical
Birsa Soya-1	5.42	Medium	4.52	Medium	53.13	Small	67.42	Medium	91.38	Spherical
KDS-743	5.10	Medium	3.81	Short	40.93	Small	50.73	Small	90.43	Spherical
KDS-749	5.02	Medium	3.95	Short	42.73	Small	51.33	Small	92.62	Spherical
BRAGG	4.59	Short	3.78	Short	55.33	Small	47.84	Small	92.77	Spherical
KDS-739	5.38	Medium	4.08	Medium	52.13	Small	60.60	Medium	89.96	Elliptical
JS-335	4.79	Short	4.16	Medium	46.00	Small	61.73	Medium	92.36	Spherical
JS-9305	4.94	Short	4.03	Medium	47.00	Small	56.80	Small	93.61	Spherical
DS-228	5.48	Medium	3.99	Short	54.00	Small	61.60	Medium	88.81	Elliptical
Mean	5.09		4.02		50.27		56.24		91.16	
S.Em±	0.17		0.11		3.10		3.58		0.79	
CD @ 1%	0.67		0.44		12.14		14.00		1.50	

Seed length : Seed width: Seed volume: Seed surface area : Seed Roundness:

Short : < 5 mm Short : < 4 mm Small : < 60 mm^3 Small : < 60 mm Spherical : < 90 mm

Medium : 5- 6 mm Medium : 4 - 5 mm Medium : 60 - 80 mm^3 Medium : 60 - 80 mm Elliptical : > 90 mm

Long : > 6 mm Long : > 5 mm Large : > 80 mm^3 Large : > 80 mm

(4-5mm) and long (>5 mm) respectively. The mean seed width of the varieties was 4.02 mm. significantly highest seed length was observed in the variety Birsa soya-1 (4.52 mm) and lowest was observed in the variety NRC-94 (3.75 mm).Among the 14 varieties seven varieties had short and sevenvarieties had medium seed width. Similar classifications were done by Paramesh (1983) in soybean and vijayageetha (2007) in mustard.

According to seed volume varieties were classified into three categories viz., small (<60 mm^3), Medium (60-80mm^3) and large (>80 mm^2) respectively. There was significant variation observed in varieties for seed volume in summer seasons. The mean seed volume of the varieties was 50.27 mm^3. Significantly highest seed volume was observed in the variety KDS-726 (60.27 mm^3) and lowest was observed in the variety KDS-743(40.93 mm^3).Among the 14 varieties thirteen varieties had small and onevariety had medium seed volume.Similar reports have been given by Quattara *et al*., (2011).

Based on seed surface area varieties were classified into three categories viz., small (<60 mm), Medium (60-80mm) and large (>80 mm) respectively. There was significant variation observed in varieties for seed surface area in summer seasons. The mean seed surface area of the varieties was 56.24 mm. significantly highest seed surface area was observed in the variety KDS-722 (67.42 mm^2) and lowest was observed in the variety BRAGG (47.84 mm^2).Among the 14 varieties nine varieties had small and five varieties had medium seed surface area. Similar report has been given by Salimpour *et al*., (2007).

According to seed roundness varieties were classified into two categories viz., spherical (<90 mm), and Elliptical (>90 mm) respectively. There was significant variation observed in varieties for seed roundness in summer seasons. The mean seed roundness of the varieties was 91.16 mm. significantly highest seed roundness was observed in the variety Bragg (92.77 mm) and lowest was observed in the variety NRC-94 (87.98 mm). Among the 14 varieties twelve varieties had spherical and threevarieties were elliptical in shape. Similar classification was used for identification and discrimination among Lucerne varieties by Dehghan *et al*., (1998).

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