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## Evaluation of Rice Genotypes for Seed Morphometric Characters by Using Seed Image Analyser

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### ABSTRACT

#### Keywords

Rice (*Oryza sativa*  
L.), Global grain,  
Seed shape

#### Article Info

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An image analysis technique is well suited for the collection of data concerning the shape and size of the seeds. Such morphological data is often used for establishing the distinctness of new varieties. Seed morphometric characters like seed length, breadth, length to breadth ratio (seed shape) and thousand seed weight were determined for hundred rice genotypes by using Biovis image analyser. As seed size is a widely accepted measure of seed quality by different scientists, study was conducted to determine whether seed size really affects seedling establishment and to its vigour in rice genotypes. Digital image analysis has proven to be a viable approach for the quantitative characterization of cultivars. It helps in distinguishing the cultivars, representing the separation of short, medium and long, as well as brown and white rice varieties using a combination of the descriptors including average length, breadth, shape factor, and compactness.

### Introduction

Rice (*Oryza sativa* L.) is a “Global Grain” cultivated widely across the world and feeds millions of mankind. It is the staple food for more than half of the human population and in Asia alone more than 2 billion people depend on rice and its products for their food intake. Seed morphometric characters *viz.*, seed size, seed width, seed length to breadth ratio (seed

shape) and thousand seed weight were determined, the genotype Gangavathi emergency was found to be numerically highest and IET-220551 genotype was found to be numerically lowest in all the seed characters and were grouped into different categories. It was noticed that seed size is related with seed vigour, larger seeds tend to produce more vigorous seedlings. The seed size indicated the amount of reserve food

supply for seedlings. Small and shrivelled seeds do not contain as much food to give the plant a vigorous start that of bold and plummy seeds. Seed size is the main factor that affects seeding rates. Seed morphometric characters play an important role in characterization and grouping of rice genotypes.

Accurate identification of genotypes or varieties for assessment of genetic variability is very useful from initial parent selection to the final utilization of cultivars in production schemes. Diversity analysis is an essential process for proper identification of the genetic relatedness of the available genetic resources. It is also required for effective choice of parents for subsequent crossing and selection of the progenies. Morphological or phenotypic descriptors have traditionally been used to distinguish one accession from the other but they are subjected to environmental influences.

### **Materials and Methods**

Hundred rice genotypes *viz.*, IET-23304, IET-26286, IET-24796, IET-22066, IET-25576, IET-25546, IET-26282, IET-26234, IET-22067, IET-25577, IET-22051, IET-24053, IET-24798, IET-24799, IET-25597, IET-25677, IET-25548, IET-25551, IET-25598, IET-25583, IET-24796, IET-25557, IET-23356, IET-23748, IET-26217, IET-26218, IET-26219, IET-26222, IET-26225, IET-25546, IET-26230, IET-26231, IET-26232, IET-26233, IET-26223, IET-26280, IET-26281, IET-26283, IET-26294, IET-26295, IET-26296, IET-23304, IET-26240, IET-23355, IET-24705, IET-25605, IET-24903, IET-24911, IET-25557, IET-25559, IET-25580, IET-24708, IET-25584, IET-23996, IET-26220, IET-26221, IET-26224, IET-26226, IET-26227, IET-26228, IET-26290, IET-26291, IET-26292, IET-26293, IET-23324, MSB-43-1-2, 23959, IR-72875-53, IET-26238, IET-26239, IET-26241, IET-

26242, IET-26243, SMW-09-32, GNV-10-89, IET-26235, IET-26236, IET-26277, IET-26289, DRR-Dhan-44, Gangavathi emergency, GNV-11-09, IABT-17, RP-Bio-26, IET-24767, IET-26237, PR-124, GNV-14-96-1, GNV-1415, KRGL-20, 26237, GNV-1405 and Biovis seed image analyser which is used as an image processing programme, less time consuming system, were used in this study and were maintained at Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, Raichur. A range of seed traits were measured using the procedures described below.

### **Morphological characters**

Seed morphological characters *viz.*, length (mm), breadth (mm) and length to breadth ratio was measured by taking ten seeds with ten replications using Biovis image analyser and were grouped into different categories. For seed length they were grouped into short (<7.5mm), medium (7.5-9mm), long (9-10mm) and very long (>10mm), for seed breadth the genotypes were classified into narrow (1.9-2.2mm), medium (2.2-2.8mm), broad (>2.88mm) and elongated (>3mm) groups and for seed length to breadth ratio (seed shape) they were grouped into spherical (<2), semi spherical (2-2.4) and semi long (2.4-3) categories. Seed colour was observed under daylight and were grouped into different groups *viz.*, straw, golden and yellow colour.

### **Results and Discussion**

Rice genotypes used for the study varied significantly for seed length, seed breadth and seed length to breadth ratio (seed shape). The highest seed length, breadth and length to breadth ratio was observed in Gangavathi emergency (11.29 mm), (3.6mm) and (3.65) lowest was found in IET-255051 (7.01mm), (1.90mm) and (2.32) respectively (Table 1).

**Table.1** Grouping of rice genotypes based on seed morphometric characters

Sl. no.	Genotypes	Seed length (mm)	Category	Seed breadth (mm)	Category	Seed length/breadth ratio	Category	Seed colour	1000 seed weight (g)	Category
1	IET-24053	8.24	Medium	2.38	Medium	3.53	Elongated	Yellow colour	14.72	Light
2	IET-23304	7.47	Short	2.17	Narrow	3.55	Elongated	Straw colour	14.88	Light
3	IET-24705	9.06	Long	3.16	Broad	2.91	Semi long	Straw colour	17.52	Light
4	IET-26286	7.29	Short	2.09	Narrow	3.56	Elongated	Yellow colour	14.18	Light
5	IET-24798	8.99	Medium	2.57	Medium	3.54	Elongated	Yellow colour	18.71	Medium
6	IET-24796	7.46	Short	2.16	Narrow	3.21	Elongated	Golden colour	17.13	Light
7	IET-24799	8.32	Medium	3.57	Broad	2.32	Semi spherical	Straw colour	20.03	Medium
8	IET-22066	7.18	Short	2.19	Narrow	3.26	Elongated	Yellow colour	14.95	Light
9	IET-25597	8.42	Medium	2.23	Medium	3.75	Elongated	Straw colour	21.13	Medium
10	IET-25600	8.83	Medium	2.74	Medium	3.17	Elongated	Straw colour	21.08	Medium
11	IET-25605	9.41	Long	2.80	Medium	3.39	Elongated	Golden colour	14.96	Light
12	IET-25548	8.77	Medium	2.64	Medium	3.35	Elongated	Golden colour	14.15	Light
13	IET-25576	7.01	Short	2.12	Narrow	2.92	Semi long	Straw colour	17.15	Light
14	IET-24903	9.52	Long	3.38	Broad	2.85	Semi long	Straw colour	19.19	Medium
15	IET-24911	9.12	Long	3.07	Broad	2.74	Semi long	Yellow colour	15.55	Light
16	IET-25551	8.96	Medium	2.29	Medium	3.99	Elongated	Straw colour	16.26	Light
17	IET-25598	8.59	Medium	2.42	Medium	3.61	Elongated	Yellow colour	15.18	Light
18	IET-24902	9.18	Long	3.37	Broad	2.78	Semi long	Straw colour	16.27	Light
Sl no.	Genotypes	Seed length (mm)	Category	Seed breadth (mm)	Category	Seed length/breadth ratio	Category	Seed colour	1000 seed weight (g)	Category
19	IET-25582	8.94	Medium	3.13	Broad	3.41	Elongated	Yellow colour	17.75	Light
20	IET-25557	9.24	Long	3.26	Broad	2.89	Semi long	Yellow colour	23.51	Heavy
21	IET-25559	9.12	Long	3.35	Broad	2.77	Semi long	Yellow colour	17.12	Light
22	IET-24796	7.53	Medium	2.23	Medium	3.88	Elongated	Straw colour	14.09	Light
23	IET-25552	8.01	Medium	2.49	Medium	3.65	Elongated	Straw colour	19.55	Medium

24	IET-23356	8.66	Medium	2.28	Medium	3.88	Elongated	Straw colour	23.46	Heavy
25	IET-23748	8.52	Medium	2.67	Medium	3.26	Elongated	Yellow colour	16.17	Light
26	IET-25580	9.46	Long	3.42	Broad	2.81	Semi long	Yellow colour	16.13	Light
27	IET-24708	9.18	Long	3.05	Broad	2.86	Semi long	Straw colour	19.87	Medium
28	IET-25584	9.55	Long	3.31	Broad	2.95	Semi long	Straw colour	20.28	Medium
29	IET-25546	7.11	Short	2.20	Narrow	2.99	Semi long	Yellow colour	20.96	Medium
30	IET-23996	9.17	Long	3.62	Broad	2.57	Semi long	Golden colour	20.87	Medium
31	IET-26217	8.94	Medium	2.37	Medium	3.81	Elongated	Straw colour	17.33	Light
32	IET-26218	8.85	Medium	2.71	Medium	3.31	Elongated	Golden colour	17.11	Light
33	IET-26219	8.16	Medium	2.59	Medium	3.42	Elongated	Straw colour	13.15	Light
34	IET-26220	9.16	Long	3.56	Broad	2.61	Semi long	Straw colour	12.77	Light
35	IET-26221	9.13	Long	3.46	Broad	2.68	Semi long	Golden colour	21.18	Medium
36	IET-26222	8.45	Medium	2.81	Broad	3.06	Elongated	Golden colour	20.19	Medium
37	IET-25546	7.69	Medium	2.29	Medium	3.23	Elongated	Straw colour	14.20	Light
38	IET-26224	9.16	Long	3.24	Broad	2.87	Semi long	Straw colour	19.28	Medium
39	IET-26225	8.7	Medium	2.54	Medium	3.45	Elongated	Yellow colour	17.06	Light
Sl no.	Genotypes	Seed length (mm)	Category	Seed breadth (mm)	Category	Seed length/breadth ratio	Category	Seed colour	1000 seed weight (g)	Category
40	IET-26226	9.14	Long	3.25	Broad	2.86	Semi long	Yellow colour	34.05	Heavy
41	IET-26227	9.24	Long	3.22	Broad	2.92	Semi long	Yellow colour	18.77	Medium
42	IET-26228	9.85	Long	3.08	Broad	3.24	Elongated	Golden colour	18.16	Medium
43	GNV-10-89	10.96	Very long	3.13	Broad	3.53	Elongated	Straw colour	26.16	Heavy
44	IET-26229	9.94	Long	3.43	Broad	3.04	Elongated	Straw colour	17.45	Light
45	IET-26230	8.72	Medium	2.20	Narrow	3.94	Elongated	Straw colour	19.25	Medium
46	IET-26231	8.95	Medium	2.58	Medium	3.52	Elongated	Golden colour	18.64	Medium
47	IET-26232	8.29	Medium	2.64	Medium	3.41	Elongated	Golden colour	21.09	Medium
48	IET-26233	8.88	Medium	2.24	Medium	4.04	Elongated	Yellow colour	20.12	Medium
49	IET-26235	10.11	Very long	3.62	Broad	2.79	Semi long	Yellow colour	19.49	Medium
50	IET-26236	10.15	Very long	3.11	Broad	3.28	Elongated	Straw colour	17.17	Light
51	IET-26277	10.07	Very long	2.92	Broad	3.48	Elongated	Golden colour	24.25	Heavy
52	IET-26278	9.76	Long	2.85	Broad	3.47	Elongated	Straw colour	23.24	Heavy

53	IET-26279	9.54	Long	3.13	Broad	3.09	Elongated	Yellow colour	24.12	Heavy
54	IET-26280	8.07	Medium	2.26	Medium	3.97	Elongated	Straw colour	17.07	Light
55	IET-26223	8.14	Medium	2.84	Broad	2.92	Semi long	Yellow colour	14.16	Light
56	IET-26281	8.38	Medium	2.34	Medium	3.61	Elongated	Yellow colour	17.94	Light
57	IET-26282	7.22	Short	2.09	Narrow	2.61	Semi long	Golden colour	14.09	Light
58	IET-26283	8.91	Medium	2.52	Medium	3.55	Elongated	Golden colour	19.49	Medium
59	IET-26284	9.14	Long	1.97	Narrow	2.80	Semi long	Straw colour	23.46	Heavy
60	IET-26285	9.01	Long	1.95	Narrow	2.83	Semi long	Yellow colour	19.57	Medium
<b>Sl no.</b>	<b>Genotypes</b>	<b>Seed length (mm)</b>	<b>Category</b>	<b>Seed breadth (mm)</b>	<b>Category</b>	<b>Seed length/breadth ratio</b>	<b>Category</b>	<b>Seed colour</b>	<b>1000 seed weight (g)</b>	<b>Category</b>
61	IET-26287	9.16	Long	2.11	Narrow	2.82	Semi long	Straw colour	18.27	Medium
62	IET-26288	9.18	Long	1.95	Narrow	2.81	Semi long	Yellow colour	17.78	Medium
63	IET-26289	10.16	Very long	2.05	Narrow	3.22	Elongated	Yellow colour	17.17	Medium
64	DRR- Dhan-44	11.13	Very long	3.54	Broad	3.38	Elongated	Straw colour	29.16	Heavy
65	Gangavathi emergency	11.29	Very long	3.66	Broad	3.65	Elongated	Golden colour	32.14	Heavy
66	GNV-11-09	10.08	Very long	3.63	Broad	3.03	Elongated	Golden colour	26.28	Heavy
67	IET-26290	9.99	Long	3.27	Broad	3.08	Elongated	Straw colour	16.36	Light
68	IET-26291	9.31	Long	3.49	Broad	2.79	Semi long	Straw colour	16.31	Light
69	IET-26292	9.39	Long	3.23	Broad	2.93	Semi long	Straw colour	17.94	Light
70	IET-26293	9.19	Long	3.53	Broad	2.64	Semi long	Golden colour	16.27	Light
71	IET-26294	8.58	Medium	2.06	Narrow	3.91	Elongated	Golden colour	21.12	Medium
72	IET-26295	8.72	Medium	2.93	Broad	3.04	Elongated	Yellow colour	16.28	Light
73	IET-26234	7.33	Short	2.14	Narrow	3.22	Elongated	Golden colour	14.08	Light
74	IET-22066	7.21	Short	2.02	Narrow	2.79	Semi long	Straw colour	14.18	Light
75	IET-26296	8.18	Medium	2.24	Medium	3.73	Elongated	Straw colour	17.14	Light
76	IET-23304	8.69	Medium	2.44	Medium	3.61	Elongated	Straw colour	16.19	Light
77	IET-25577	7.48	Short	2.57	Medium	3.74	Elongated	Straw colour	14.19	Light
78	IET-23324	9.19	Long	3.17	Broad	2.94	Semi long	Yellow colour	19.98	Medium
79	MSB-43-1-2	9.97	Long	3.39	Broad	2.99	Semi long	Straw colour	20.17	Medium
80	IET-23959	9.28	Long	3.61	Broad	2.61	Semi long	Yellow colour	20.91	Medium
<b>Sl</b>	<b>Genotypes</b>	<b>Seed</b>	<b>Category</b>	<b>Seed</b>	<b>Category</b>	<b>Seed</b>	<b>Category</b>	<b>Seed colour</b>	<b>1000</b>	<b>Category</b>

no.		length (mm)		breadth (mm)		length/breadth ratio			seed weight (g)	
81	IABT-17	11.08	Very long	3.32	Broad	3.39	Elongated	Yellow colour	32.11	Heavy
82	IET-255051	7.01	Short	1.90	Narrow	2.32	Semi spherical	Yellow colour	13.69	Light
83	IR-72875-5-3	9.11	Long	3.85	Broad	2.40	Semi spherical	Straw colour	15.18	Light
84	IET-23355	8.94	Medium	2.39	Medium	3.80	Elongated	Yellow colour	17.28	Light
85	RP-Bio-226	11.17	Very long	3.11	Broad	3.56	Elongated	Yellow colour	27.11	Heavy
86	IET-24767	10.16	Very long	3.47	Broad	3.03	Elongated	Straw colour	16.28	Light
87	PR-124	11.24	Very long	3.28	Broad	3.47	Elongated	Straw colour	32.16	Heavy
88	IET-26237	10.07	Very long	3.18	Broad	3.24	Elongated	Yellow colour	17.43	Light
89	IET-26238	9.36	Long	3.48	Broad	2.72	Semi long	Yellow colour	15.79	Light
90	IET-26239	9.89	Long	3.18	Broad	3.16	Elongated	Straw colour	15.54	Light
91	IET-26240	8.39	Medium	2.24	Medium	3.78	Elongated	Straw colour	23.47	Heavy
92	IET-26241	9.19	Long	3.53	Broad	2.66	Semi long	Golden colour	15.17	Light
93	SMW-09-32	9.69	Long	3.12	Broad	3.14	Elongated	Golden colour	18.69	Medium
94	IET-26242	9.98	Long	3.28	Broad	3.09	Elongated	Golden colour	17.68	Light
95	IET-26243	9.49	Long	3.17	Broad	3.03	Elongated	Straw colour	15.14	Light
96	GNV-14-96-1	11.28	Very long	3.19	Broad	3.14	Elongated	Straw colour	25.68	Heavy
97	GNV-1415	10.62	Very long	3.22	Broad	3.31	Elongated	Yellow colour	31.18	Heavy
98	IET-26247	10.09	Very long	3.14	Broad	3.37	Elongated	Yellow colour	19.18	Medium
99	KRGL-20	11.03	Very long	3.09	Broad	3.61	Elongated	Yellow colour	17.69	Light
100	GNV-1405	10.08	Very long	2.88	Broad	3.63	Elongated	Straw colour	32.14	Heavy
	<b>Mean</b>	<b>9.08</b>		<b>2.84</b>		<b>3.20</b>			19.12	
	<b>Minimum</b>	<b>7.01</b>		<b>1.90</b>		<b>2.32</b>			13.69	
	<b>Maximum</b>	<b>11.29</b>		<b>3.66</b>		<b>3.65</b>			32.14	
	<b>S.Em±</b>	<b>0.02</b>		<b>0.27</b>		<b>0.03</b>			0.04	
	<b>CD@1%</b>	<b>0.07</b>		<b>1.01</b>		<b>0.12</b>			0.13	

Category: Seed length; Category: Seed breadth; Category: Seed length/breadth ratio (Seed shape); Category: 1000 seed weight; Light: 12-18g  
 Short: < 7.5 mm                      Narrow: 1.9-2.2 mm                      Spherical: < 2.0                      Medium: 18-23g  
 Medium: 7.5-9 mm                      Medium: 2.2-2.8 mm                      Semi spherical: 2-2.4                      Heavy: > 23g  
 Long: 9-10 mm                      Broad: > 2.8 mm                      Semi-long: 2.4-3  
 Very long: >10 mm                      Elongated: > 3mm

Based on the mean of seed length, breadth and shape the genotypes were grouped into different categories.

Seed morphological studies can be made automatically by using Image Analysis System, *i.e.*, by Biovis Seed Image Analyser. Seed morphological characters *viz.*, size, length, breadth, length to breadth ratio and colour were used for genotype characterization.

A digital image analysis provides an alternative to the manual classification of biological seed by integrating an image acquisition device and a computer. Similar works were carried out by Mattana *et al.*, (2008), Firathgil *et al.*, (2010), Chavan (2010), Medina *et al.*, (2010), Bacchetta *et al.*, (2011) and Grillo *et al.*, (2011).

Genetic analysis of these two quantitative traits have been reported by many scientists and most have shown that grain shape of rice is quantitatively inherited Zhang *et al.*, (2007) showed that rice grain shape is controlled by triploid endosperm gene, cytoplasmic gene and genotype by environment interaction.

Based on the colour of the seed, the genotypes were classified into three groups golden colour, straw colour and yellow colour. However, the seed colour is also influenced by environmental conditions during ripening, besides the genetic effect (Pascual *et al.*, 1993). Thus, it is important to note that such comparisons are valid only, if the crop is not adversely affected by rains, moulds or any other biotic and abiotic stresses and the crop is grown under similar agro-climatic conditions. Seed colour is considered to be a heritable character and has been used by several scientists to distinguish crop genotypes (Chakrabarty and Agarwal, 1990; Agarwal and Pawar, 1990), particularly in rice (Nethra, 2003 and Rimpi, 2008).

The genotype Gangavathi emergency possess highest while IET-255051 possess lowest seed length, seed breadth, seed length to breadth ratio, other different rice genotypes. Seeds having more seed weight and seed size have higher seedling vigour which are preferred for better crop establishment. Seed size will be more influential parameter for processing and fixing the seed rate. Hence each variety will be having varied seed rates. The study helps to know the vigour, seed rate, processing designing and fineness for consumption. It is useful for seed industry as well as commercial food industry. An image analysis technique is well suited for the collection of data concerning the shape and size of objects and this applies to plant organs as well as seeds. Such morphological data is often used for establishing the distinctness of new varieties in statutory plant breeding schemes.

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