

DUS Characterization for Farmer varieties of rice

¹L.V.Subba Rao, ²G.Shiva Prasad, ¹M.Chiranjivi ¹U.Chaitanya and
¹R.Surendhar

1. Directorate of Rice Research, Rajendranagar, Hyderabad-500030, Andhra Pradesh, India.
2. Department of Genetics and Plant Breeding, College of Agriculture, ANGR Agricultural University, Rajendranagar, Hyderabad-500030, Andhra Pradesh, India

Abstract: For the establishment of the distinctness among Sixty-five landraces of rice, forty three characters were used. Characterization of Sixty-five landraces of rice was done using forty three agro-morphological traits following Distinctiveness, Uniformity and Stability test (DUS) during kharif season of 2011 at the DRR farm, ICRISAT campus. Out of Sixty-five varieties studied, thirty-two were found to be distinctive on the basis of twenty two essential and twenty four additional characters. This study will be useful for breeders, researchers and farmers to identify and choose the restoration and conservation of beneficial genes for crop improvement and also to seek protection under Protection of Plant Varieties and Farmer's Rights Act.

Key words: DUS test, Rice farmer varieties, Characterization, PPV & FR Act

I. Introduction:

Rice is the world's most important food crop and a primary food source for more than one third of world's population (1). The essence of plant breeding lies in the creation of genetic variation which is a prerequisite for any improvement in crop. The development of one or more varieties depends on the final selection of superior plants by the plant breeder who uses several techniques to create the genetic variation and to select from within that variation (2). India has a rich and wide range of genetic wealth of rice. It has been estimated from various surveys that nearly 50,000 of rice is still being grown in the country (3). With the introduction of high yielding varieties and new technologies become a great threat to the security of the age-old practice of growing traditional varieties and landraces which may have immense potential for different important traits (4). As the existing UPOV models of plant variety protection were not suitable for Indian requirements, the Government of India enacted our own legislation on the "Protection of Plant Varieties and Farmers Act" (PPV&FRA) in 2001 for providing protection to plant varieties based on distinctiveness, uniformity and stability (DUS) test apart from novelty. which is a unique and model act which gives equal importance to the farmers and breeders and treats them as partners in their efforts for sustainable food security(5). Thus the process of variety identification includes several steps were identification of a variety, Confirmation of the variety, Distinctness of the variety from all other in common knowledge, Purity of the variety and Characterization of the variety which enumerates its full descriptors. The concept of distinctness, uniformity and stability are thus fundamental to the characterization of a variety as a unique creation. Registration is allowed for three types of plant varieties new varieties bred by breeders, extant varieties and farmer's varieties subject to their fulfilling the conditions of Distinctness, Uniformity and Stability and Novelty in case of breeder's variety. The uniqueness of a particular variety is to be established by the test called DUS. The first step to implement our PPV&FR Act provisions is formulation of National Test Guidelines for conducting DUS tests. In this context, an attempt was made to characterize a set of Sixty-five farmer's varieties of rice germplasm for different morphological and agronomic traits and identify the variability available in the collection. (6)

II. Materials and Methods:

Sixty five farmer's varieties of rice (Table 1) were grown in a randomized complete block design with two replication s at the DRR farm, ICRISAT campus, Situated at 17.53°N latitude, 78.27°E longitude and altitude of 545m above mean sea level. The material was grown in a complete randomized block design with five checks in two replications during *Kharif* 2011. Each entry was sown in three rows of 2m length at spacing of 20 cm between rows and 15 cm between plants. Crop was raised following recommended package of practices. Observations were recorded on five randomly chosen plants of each genotype per replication for twenty-two morphological and agronomical traits. Among the qualitative trait, forty six (22 essential and 24 additional) visually assessed characteristics were observed according to the National Test Guidelines for DUS test in rice which was developed by Directorate of Rice Research Rajendarnagar, Hyderabad (7). The observation of various characteristics was recorded at different stages of growth with appropriate procedures as per the DUS test guidelines of PPV & FR Act, 2001. Like UPOV, in PPV and FR Act, a variety must fulfil the

criteria of Distinctiveness, Uniformity, Stability and novelty (if new) so as to get protection under this act (8). The traits studied were Coleoptile colour, Basal leaf Sheath colour, Intensity of green colour of leaf , Anthocyanin colouration, Pubescence of Leaf blade surface, Auricles, Anthocyanin colouration of auricles, Leaf collar, Anthocyanin colouration of colla, Shape of ligule, Colour of ligule, Length leaf of blade, Width of Leaf blade, Culm attitude, Time of heading, Attitude of Flag leaf blade, Spikelet, Density of pubescence of lemma, Male sterility, Anthocyanin colouration of keel, Anthocyanin colouration of area below apex, Anthocyanin colouration of apex, Colour of stigma, Stem thickness, Stem Length, Anthocyanin colouration of nodes, Anthocyanin colouration of internodes, Panicle length of main axis, Curvature of Panicle main axis, Number of panicle per plant, Colour of tip of lemma, Lemma and Palea Colour, Panicle awns, Presence of secondary branching, Attitude of branches, Panicle exertion, Time maturity (days), Leaf Senescence, Sterile lemma colour, 1000 grain Weight, Grain length, Grain width, Phenol reaction of lemma, Decorticated grain length, Decorticated grain width, Decorticated grain shape, Decorticated grain colour, Presence of amylose in endosperm, Content of amylase in endosperm, Expression of white core in polished grain, Gelatinization temperature through alkali spreading value, Decorticated grain Aroma.

Table: 1. List of farmer’s varieties and place of collection:

S. No	Cultivator	Place of collection	Cultivar	Place of collection	Cultivar	Place of collection
1	BADI	CRRI, Orissa	PANKAPOTA	CRRI, Orissa	SHIULI	CRRI, Orissa
2	LALUBODI KABERI	CRRI, Orissa	DANASARIA	CRRI, Orissa	BASTABHOG	CRRI, Orissa
3	SUNAPANI	CRRI, Orissa	KARANI	CRRI, Orissa	KALIA	CRRI, Orissa
4	SAPARI	CRRI, Orissa	LAL GORI	CRRI, Orissa	DENGERCHUDI	CRRI, Orissa
5	JAKSARU	CRRI, Orissa	BASPATRI	CRRI, Orissa	NAGRA	CRRI, Orissa
6	SAMUDRABALI	CRRI, Orissa	PUAGLI	CRRI, Orissa	SENKARA	CRRI, Orissa
7	MACHAKANTA	CRRI, Orissa	CHINGER	CRRI, Orissa	GHOES	CRRI, Orissa
8	HALDI CHUDI	CRRI, Orissa	KANTA DUMER	CRRI, Orissa	KANAKACHUR	CRRI, Orissa
9	LIKITIMACHI	CRRI, Orissa	KADALIKENDA	CRRI, Orissa	KERALASUNDARI	CRRI, Orissa
10	Koliha	CRRI, Orissa	KUSUMA	CRRI, Orissa	ASIT KALMA	CRRI, Orissa
11	MALPATRI	CRRI, Orissa	RAMACHANDRA BOITA	CRRI, Orissa	PORASENKARA	CRRI, Orissa
12	GELEI	CRRI, Orissa	MEDI	CRRI, Orissa	BAHURUPI	CRRI, Orissa
13	MAGURA	CRRI, Orissa	KALABHUTIA	CRRI, Orissa	RANIKAJAL	CRRI, Orissa
14	SUNAMUKI	CRRI, Orissa	JUGAL	CRRI, Orissa	BENAPPOOL	CRRI, Orissa
15	LOCHEI	CRRI, Orissa	DUDHSAR	CRRI, Orissa	KARPUR BHOG	CRRI, Orissa
16	KORKOILI	CRRI, Orissa	KELAS	CRRI, Orissa	NINIBUDHI	CRRI, Orissa
17	HARISHANKARA	CRRI, Orissa	GOVINDBHOG	CRRI, Orissa	BIDAN SAPRU	CRRI, Orissa
18	SAMULEI	CRRI, Orissa	CHAMARMANI	CRRI, Orissa	LADARI	CRRI, Orissa
19	Bastul	CRRI, Orissa	NINI	CRRI, Orissa	DENGABARI	CRRI, Orissa
20	SARSONFUL	CRRI, Orissa	LILAVATI	CRRI, Orissa	KUSUMA KUNTALA	CRRI, Orissa
21	SEKTA	CRRI, Orissa	KATHIA	CRRI, Orissa	KALAJIRA	CRRI, Orissa
22	RATANCHUDI	CRRI, Orissa	DHABALABHUTA	CRRI, Orissa	CRRI: Central Rice Research Institute	

Table 2: Essential characters along with descriptor

S.No	Characteristics	Strategies							
1	Coleoptile: Colour	Colourless	Green	Purple					
2	Basal leaf: Sheath colour	Green	Light purple	Purple lines	Uniform purple				
3	Leaf: Intensity of green colour	Light	Medium	Dark					
4	Leaf: Anthocyanin colouration	Absent	Present						
5	Leaf sheath: Anthocyanin colouration	Absent	Present						

S.No	Characteristics	Strategies								
6	Leaf: Pubescence of blade surface	Absent	Weak	Medium	Strong					
7	Leaf: Auricles	Absent	Present							
8	Leaf: Anthocyanin colouration of auricles	Colourless	Light purple	Purple						
9	Leaf: Collar	Absent	Present							
10	Leaf: Anthocyanin colouration of collar	Absent	Present							
11	Leaf: Ligule	Absent	Present							
12	Leaf: Shape of ligule	Truncate	Acute	Split						
13	Leaf: Colour of ligule	White	Light purple	Purple						
14	Leaf: Length of blade	Short (<30 cm)	Medium (30-45 cm)	Long (>45 cm)						
15	Leaf: Width of blade	Narrow (< 1 cm)	Medium (1-2 cm)	Broad (> 2cm)						
16	Culm: Attitude	Erect	Semi-erect	Open	Spreading					
17	Time of heading (50 % of plants with panicles)	Very early (<71 days)	Early (71-90 days)	Medium (91-110 days)	Late (111-130 days)	Very late (> 131 days)				
18	Flag leaf: Attitude of blade (early observation)	Erect	Semi-erect	Horizontal	Drooping					
19	Spikelet: Density of pubescence of lemma	Absent	Weak	Medium	Strong	Very strong				
20	Male sterility	Absent	Present							
21	Lemma: Anthocyanin colouration of keel	Absent / Very weak	Weak	Medium	Strong	Very strong				
22	Lemma: Anthocyanin colouration of area below apex	Absent	Weak	Medium	Strong	Very strong				
23	Lemma: Anthocyanin colouration of apex	Absent	Weak	Medium	Strong	Very strong				
24	Spikelet: Colour of stigma	White	Light green	Yellow	Light purple	Purple				
25	Stem: Thickness	Thin (<0.40cm)	Medium (0.40-0.55 cm)	Thick (>0.55cm)						

S.No	Characteristics	Strategies									
26	Stem: Length (excluding panicle; excluding floating rice)	Very short (<91cm)	Short (91-110 cm)	Medium (111-130 cm)	Long (131-150 cm)	Very long (>150 cm)					
27	Stem: Anthocyanin colouration of nodes	Absent	Present								
28	Stem: Anthocyanin colouration of internodes	Absent	Present								
29	Panicle: Length of main axis	Very short (<16 cm)	Short (16-20 cm)	Medium (21-25 cm)	Long (26-30 cm)	Very long (>30 cm)					
30	Flag leaf: Attitude of blade (late observation)	Erect	Semi-erect	Horizontal	Deflexed						
31	Panicle: Curvature of main axis	Straight	Semi-straight	Deflexed	Dropping						
32	Panicle: Number per plant	Few (<11)	Medium (11-20)	Many (>20)							
33	Spikelet: Colour of tip of lemma	White	Yellowish	Brown	Red	Purple	Black				
34	Lemma and Palea: Colour	Straw	Gold and gold furrows on straw background	Brown spots on straw	Brown furrows on straw	Brown (tawny)	Reddish to light purple	Purple spots / furrows on straw	Purple	Black	
35	Panicle: Awns	Absent	Present								
36	Panicle: Presence of secondary branching	Absent	Present								
37	Panicle: Secondary branching	Weak	Strong	Clustered							
38	Panicle: Attitude of branches	Erect	Erect to semi-Erect	Semi-erect	Semi-erect to spreading	Spreading					
39	Panicle: Exertion	Partly exerted	Mostly exerted	Well exerted							
40	Time maturity (days)	Very early (<100)	Early (101-120)	Medium (121-140)	Late (141-160)	Very late (>160)					
41	Leaf: Senescence	Early	Medium	Late							
42	Sterile lemma: Colour	Straw	Gold	Red	Purple						
43	Grain: Weight of 1000 fully developed grains	Very low (<15 g)	Low (15-20 g)	Medium (21-25 g)	High (26-30 g)	Very high (>30 g)					

III. Results and Discussion:

To establish distinctiveness among rice cultivars, 46 characters have been used. Qualitative characters are considered as morphological markers in the identification of landraces of rice, because they are less influenced by environmental changes (9). Regarding leaf characteristics (Table 3), intensity of green colour was

dark in 16 cultivars. Out of sixty-five cultivars 11 cultivars had leaf anthocyanin colouration. Anthocyanin coloration in leaf sheath was present in 11 cultivars, out of which 4 cultivars were found to be distinct for having strong pubescence while 19 cultivars were marked for absence of pubescence in leaf blade.

All 65 cultivars exhibited presence of leaf auricle. 7 out of 65 cultivars shown purple auricle. With respect to leaf collar all cultivars showed for it's presence. Except 11 cultivars remaining shoed absence of anthocyanin colouration for the leaf collar. All the cultivars were having acute shape of ligule. 6 cultivars posses purple colour of ligule and 4 are of light purple. Out of 64 cultivars 28 showed long leaf blade, were as 31 are of medium type and 6 were of narrow width of leaf blade. For the character culm attitude, 7 cultivars were of erect type , 21 were of open type but only 1 cultivar(NINIBUDHI) having spreading type of culm. Cultivar "kusuma kuntala" showed very early time of heading and 40 were of medium type but Nagra and BAHURUPI cultivars were of late type. Erect type of flag leaf was observed for 7 cultivars, variety GHoes having horizontal type but remaining were of semi erect type. For density of pubescence of lemma 23 were of strong pubescence 35 were of medium type and 4 were of obscene of pubescence.

It is important to note that no cultivar exhibited male sterility. 4 cultivars showed strong coloration but KALAJIRA found it's of very strong and remaining were shown absence anthocyanin coloration of keel. 7 cultivars were of strong , 2 cultivars were of very strong, 1 is medium and remaining cultivars shown obscene of anthocyanin colouration of area below the apex. For colour of stigma 42 cultivars shown white, 7 were of light purple and 16 were of purple colour. With respect to thickness of stem 6 cultivars were of thin, 53 were of medium and 6 were of thick. For the stem length (excluding panicle) 25 cultivars were of very short 32 were of short 7 and 1 were of medium and long respectively. 53 cultivars were shown absence for anthocyanin colouration of node and reaming 12 found presence for the character. Similarly for anthocyanin colouration of inter node 57 were absence and 8 shown presence for the character. Panicle length for 2 cultivars was of short, 49 were of medium, 13 were of long but only one was of very long. Flag leaf (attitude of blade) 41 were of semi erect 19 were of horizontal, 3 were deflexed and only 2 cultivars were of erect type. For the character panicle (curvature of main axis) 23 were of deflexed, 29 were of drooping, 11 were of semi straight and 2 were of straight. With respect to panicle number per plant 56 cultivars exhibited medium number, 5 were many and 4 were of few type.

Colour of tip of lemma 19 were of white, 12 were of yellowish 13 were brown , 10 were black, 4 and 3 were of red and purple colour respectively. For the character lemma and palea colour 20 cultivars were of straw colour 10 were of gold, 13 were of brown, 9 were black, 8 were brown (tawny). 55 cultivars were shown absence of awns and 10 were shown presence of awns. All the 65 cultivars exhibited presence of secondary branching. 4 cultivars were of strong secondary branching and remaining were of weak in nature. Semi erect to spreading was observed for 21 cultivars 20 were of semi erect 14 were of erect to semi erect but 8 were of spreading type. Mostly that is 47 cultivars were of well exerted panicle exertion, 17 were of mostly exerted type, but only one cultivar is of partly exerted type. For about 33 cultivars the time maturity was medium (121-140 days), 21 were of early (101-120days) 11 were of late(141-160). For the character leaf senescence 31 were of late, 27 were of medium and 7 were of early type. 53 cultivars were of straw sterile lemma colour, 8 were of red, 2 were of gold and purple. For the grain weight 23 cultivars shown medium weight(21-25gr), 17 were of low(15-20), 12 were of high(26-30), 11 were of very low(<15gr) and 2 cultivars were shown very high grain weight(>30gr).

IV. Conclusion :

Thus, it is concluded that out of 65 landraces of rice, 32 cultivars were found to be distinctive on the basis of 22 essential and 24 additional characters. This study will be useful for breeders, researchers and farmers to identify and choose the restoration and conservation of beneficial genes for crop improvement.

Table 3. Characterization of the cultivars (total 65) as per DUS guidelines

S. No	Cultivator	Descriptors/Characters														
		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
1	BADI	1	2	7	1	9	5	9	1	9	1	9	3	1	5	5
2	LALUBODI KABERI	1	2	7	1	9	1	9	1	9	1	9	3	1	7	5
3	SUNAPANI	1	1	5	1	1	1	9	1	9	1	9	3	1	5	5
4	SAPARI	1	1	3	1	1	5	9	1	9	1	9	3	1	5	5
5	JAKSARU	1	1	5	1	1	5	9	1	9	1	9	3	1	5	3
6	SAMUDRABALI	1	1	5	1	1	1	9	1	9	1	9	3	1	5	5
7	MACHAKANTA	1	1	5	1	1	5	9	1	9	1	9	3	1	7	5
8	HALDI CHUDI	1	1	7	1	1	7	9	1	9	1	9	3	1	7	5
9	LIKITIMACHI	1	1	3	1	1	1	9	3	9	9	9	3	3	7	5
10	Koliha	2	1	5	1	1	7	9	1	9	1	9	3	1	5	3
11	MALPATRI	1	1	3	1	1	3	9	1	9	1	9	3	1	7	5
12	GELEI	1	1	5	1	1	5	9	1	9	1	9	3	1	5	5

S. No	Cultivator	Descriptors/Characters														
		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
13	MAGURA	1	1	5	1	1	7	9	1	9	1	9	3	1	7	5
14	SUNAMUKI	1	1	5	1	1	3	9	1	9	1	9	3	1	5	3
15	LOCHEI	1	1	5	1	1	5	9	1	9	1	9	3	1	5	3
16	KORKOILI	1	4	5	9	9	7	9	3	9	9	9	3	3	7	5
17	HARISHANKARA	1	1	5	1	1	3	9	1	9	1	9	3	1	7	5
18	SAMULEI	1	1	3	1	1	7	9	1	9	1	9	3	1	5	5
19	Bastul	2	1	7	1	1	7	9	1	9	1	9	3	1	3	3
20	SARSONFUL	1	1	5	9	1	1	9	2	9	9	9	3	2	5	5
21	SEKTA	1	1	3	1	1	3	9	1	9	1	9	3	1	5	5
22	PANKAPOTA	1	1	5	1	1	5	9	1	9	1	9	3	1	5	5
23	DANASARIA	1	1	5	1	1	7	9	1	9	1	9	3	1	5	5
24	KARANI	1	2	5	1	9	7	9	1	9	1	9	3	1	3	5
25	LAL GORI	1	1	7	1	1	9	9	1	9	1	9	3	1	7	5
26	BASPATRI	1	1	7	1	1	1	9	1	9	1	9	3	1	7	5
27	PUAGLI	1	1	7	1	1	3	9	1	9	1	9	3	1	7	5
28	CHINGER	1	1	5	1	1	5	9	1	9	1	9	3	1	3	5
29	KANTA DUMER	1	1	5	1	1	7	9	1	9	1	9	3	1	5	5
30	KADALIKENDA	1	1	7	1	1	3	9	1	9	1	9	3	1	5	5
31	KUSUMA	1	1	5	1	1	5	9	1	9	1	9	3	1	5	5
32	RAMACHANDRA BOITA	3	4	5	1	9	7	9	3	9	9	9	3	1	5	3
33	MEDI	1	4	7	9	9	5	9	2	9	9	9	3	3	7	5
34	KALABHUTIA	1	4	5	9	9	7	9	2	9	9	9	3	2	7	5
35	JUGAL	1	4	7	9	9	7	9	2	9	9	9	3	2	5	5
36	DUDHSAR	1	1	5	1	1	5	9	1	9	1	9	3	1	7	3
37	KELAS	1	3	3	1	9	5	9	1	9	1	9	3	1	5	5
38	GOVINDBHOG	1	1	5	1	1	1	9	1	9	1	9	3	1	7	5
39	CHAMARMANI	1	1	5	1	1	9	9	1	9	1	9	3	1	7	5
40	NINI	1	1	7	1	1	1	9	1	9	1	9	3	1	7	5
41	LILAVATI	1	1	5	1	1	1	9	1	9	1	9	3	1	7	5
42	SHIULI	1	1	3	1	1	5	9	1	9	1	9	3	1	5	5
43	BASTABHOG	1	1	5	1	1	1	9	1	9	1	9	3	1	5	5
44	KALIA	1	4	7	9	9	9	9	3	9	9	9	3	3	7	3
45	DENGERCHUDI	1	1	3	1	1	3	9	1	9	1	9	3	1	5	5
46	NAGRA	1	1	3	1	1	7	9	1	9	1	9	3	1	7	5
47	SENKARA	1	1	5	1	1	5	9	1	9	1	9	3	1	5	5
48	GHOES	1	1	5	1	1	5	9	1	9	1	9	3	1	7	5
49	KANAKACHUR	1	1	5	1	1	1	9	1	9	1	9	3	1	5	5
50	KERALASUNDARI	1	1	7	1	1	5	9	2	9	1	9	3	1	5	5
51	ASIT KALMA	1	1	7	1	1	5	9	1	9	1	9	3	1	7	5
52	PORASENKARA	1	1	3	1	1	1	9	1	9	1	9	3	1	5	5
53	BAHURUPI	1	1	3	1	1	9	9	1	9	1	9	3	1	7	5
54	RANIKAJAL	1	1	5	1	1	1	9	1	9	1	9	3	1	5	3
55	BENAPPOOL	1	1	3	1	1	5	9	3	9	9	9	3	3	7	5
56	KARPUR BHOG	1	1	7	9	1	1	9	1	9	1	9	3	1	7	5
57	NINIBUDHI	1	1	5	1	1	1	9	1	9	1	9	3	1	5	5
58	BIDAN SAPRU	1	1	5	1	1	1	9	1	9	1	9	3	1	7	5
59	LADARI	1	1	3	1	1	3	9	1	9	1	9	3	1	7	5
60	DENGABARI	1	1	5	9	1	3	9	1	9	1	9	3	1	7	5
61	KUSUMA KUNTALA	1	1	5	1	1	1	9	1	9	1	9	3	1	5	3
62	KALAJIRA	1	1	7	9	1	1	9	1	9	1	9	3	1	7	5
63	KATHIA	1	4	5	9	1	5	9	3	9	9	9	3	2	5	5
64	RATANCHUDI	1	1	5	1	1	1	9	1	9	1	9	3	1	7	5
65	DHABALABHUTA	1	4	5	9	9	5	9	3	9	9	9	3	3	7	5

Coleoptile: Colour-a, Basal leaf: Sheath colour-b, Leaf: Intensity of green colour-c, Leaf: Anthocyanin colouration-d, Leaf sheath: Anthocyanin colouration-e, Leaf: Pubescence of blade surface-f, Leaf: Auricles-g, Leaf: Anthocyanin colouration of auricles-h, Leaf: Collar-i, Leaf: Anthocyanin colouration of colla-j, Leaf: Ligule-k, Leaf: Shape of ligule-l, Leaf: Colour of ligule-m, Leaf: Length of blade-n, Leaf: Width of blade-o,

S. No	Cultivator	Descriptors/Characters													
		p	q	r	s	t	u	v	x	y	z	aa	ab	ac	ad
1	BADI	3	5	3	7	1	1	1	1	4	5	5	1	1	7
2	LALUBODI KABERI	5	3	3	7	1	1	1	9	5	5	3	1	1	5
3	SUNAPANI	5	5	3	5	1	1	1	1	1	5	3	1	1	5
4	SAPARI	3	5	1	7	1	1	1	5	5	5	1	1	1	5
5	JAKSARU	3	3	3	7	1	1	1	1	1	3	1	1	1	5
6	SAMUDRABALI	5	5	3	7	1	1	1	1	1	3	3	1	1	7
7	MACHAKANTA	5	5	3	5	1	1	1	1	1	5	3	1	1	5
8	HALDI CHUDI	3	5	3	5	1	1	1	1	1	5	3	1	1	5
9	LIKITIMACHI	3	5	3	7	1	7	7	9	1	5	3	9	9	5
10	Koliha	3	3	1	7	1	1	1	1	1	5	1	1	1	5
11	MALPATRI	3	5	3	5	1	1	1	1	1	5	1	1	1	5
12	GELEI	3	5	3	7	1	1	1	1	1	5	3	1	1	5
13	MAGURA	5	5	3	5	1	1	5	7	5	7	1	1	1	5
14	SUNAMUKI	3	3	3	5	1	1	1	1	1	5	1	1	1	5
15	LOCHEI	5	5	3	5	1	1	1	1	1	5	3	1	1	7
16	KORKOILI	5	5	3	5	1	1	1	7	5	7	5	9	9	5
17	HARISHANKARA	3	5	3	5	1	1	1	1	1	5	3	1	1	5
18	SAMULEI	5	5	3	5	1	1	1	1	1	3	3	1	1	5
19	Bastul	3	3	1	7	1	1	1	1	1	5	1	1	1	7
20	SARSONFUL	3	5	3	7	1	1	1	9	1	5	3	9	1	5
21	SEKTA	5	3	3	5	1	1	1	3	4	5	1	1	1	5
22	PANKAPOTA	5	5	3	7	1	1	1	1	4	5	3	1	1	5
23	DANASARIA	3	5	1	7	1	1	1	3	1	5	1	1	1	5
24	KARANI	5	3	3	5	1	1	1	5	4	3	1	1	1	3
25	LAL GORI	3	5	3	7	1	1	1	1	1	5	3	1	1	5
26	BASPATRI	3	5	3	7	1	1	1	1	1	5	3	1	1	7
27	PUAGLI	3	5	3	7	1	1	1	1	1	5	3	1	1	5
28	CHINGER	5	3	3	5	1	1	1	1	5	3	1	1	1	5
29	KANTA DUMER	5	3	3	5	1	1	1	5	4	5	1	1	1	5
30	KADALIKENDA	3	5	3	7	1	1	1	1	1	5	3	1	1	5
31	KUSUMA	5	3	3	7	1	1	1	1	4	3	1	1	1	5
32	RAMACHANDRA BOITA	1	5	3	1	7	1	7	7	5	5	7	9	9	7
33	MEDI	5	3	3	5	1	1	1	7	5	5	3	9	1	5
34	KALABHUTIA	3	5	1	7	1	7	7	7	5	7	3	9	1	7
35	JUGAL	3	5	3	7	1	1	1	7	5	5	5	9	9	5
36	DUDHSAR	1	5	3		1	1	1	1	1		3	1	1	5
37	KELAS	3	3	3	5	1	1	1	7	5	5	1	9	1	5
38	GOVINDBHOG	3	3	3	5	1	1	1	1	1	5	3	1	1	7
39	CHAMARMANI	1	5	3		1	1	1	1	1	5	5	1	1	5
40	NINI	3	5	3	5	1	1	7	1	1	5	5	1	1	7
41	LILAVATI	1	5	3	5	1	1	1	1	1	5	3	1	1	7
42	SHIULI	1	5	1	5	1	1	1	1	1	5	1	1	1	5
43	BASTABHOG	3	5	3	5	1	1	1	1	1	5	3	1	1	7
44	KALIA	3	5	3	5	1	7	7	9	1	5	5	9	9	7
45	DENGERCHUDI	3	3	3	5	1	1	1	1	1	5	3	1	1	5
46	NAGRA	1	7	1	7	1	1	1	1	1	5	1	1	1	5
47	SENKARA	5	3	3	5	1	1	1	5	1	5	1	1	1	5
48	GHOES	1	5	5	5	1	1	1	1	1	5	3	1	1	5
49	KANAKACHUR	3	3	3	7	1	1	1	1	1	5	3	1	1	7
50	KERALASUNDARI	3	5	3	7	1	1	1	1	1	5	1	1	1	5
51	ASIT KALMA	5	5	3	5	1	1	1	1	1	5	1	1	1	5
52	PORASENKARA	5	3	3	5	1	1	1	1	1	5	1	1	1	5
53	BAHURUPI	3	7	3	5	1	1	1	1	1	7	1	1	1	5
54	RANIKAJAL	5	5	3	5	1	7	9	9	1	5	5	1	1	5
55	BENAPOL	3	5	3	5	1	1	1	7	5	5	3	9	9	5
56	KARPUR BHOG	5	5	3	5	1	1	7	9	1	5	3	1	1	5
57	NINIBUDHI	7	3	3	7	1	1	1	5	4	5	1	1	1	5
58	BIDAN SAPRU	5	5	3	5	1	1	1	1	1	5	3	1	1	5
59	LADARI	3	3	3	5	1	1	7	7	5	5	1	1	1	5
60	DENGABARI	5	3	3	5	1	1	1	7	5	5	3	1	1	5
61	KUSUMA KUNTALA		1	3	3	1	1	1	7	5	7	3	1	1	3
62	KALAJIRA	5	3	3	3	1	9	9	7	1	5	3	1	1	9
63	KATHIA	5	3	3	3	1	1	1	7	5	5	1	9	9	5
64	RATANCHUDI	1	5	3		1	1	1	1	1	5	3	1	1	5
65	DHALABHUTA	5	5	3	5	1	1	1		5	5	1	9	9	5

Culm: Attitude-p, Time of heading (50 % of plants with panicles)-q, Flag leaf: Attitude of blade (early observation)-r Spikelet: Density of pubescence of lemma-s, Male sterility-t, Lemma: Anthocyanin colouration of keel-u, Lemma: Anthocyanin colouration of area below apex-v, Lemma: Anthocyanin colouration of apex-x, Spikelet: Colour of stigma-y, Stem: Thickness-z, Stem: Length (excluding panicle; excluding floating rice)-aa, Stem: Anthocyanin colouration of nodes-ab, Stem: Anthocyanin colouration of internodes-ac, Panicle: Length of main axis-ad,

S. No	Cultivator	ae	af	ag	ah	ai	aj	ak	al	am	an	ao	ap	aq	ar
1	BADI	5	7	5	3	1	1	9	2	7	7	5	7	4	5
2	LALUBODI KABERI	5	5	5	3	4	1	9	2	5	7	3	3	1	5
3	SUNAPANI	5	7	5	2	4	1	9	1	5	5	5	5	1	3
4	SAPARI	3	7	5	1	1	1	9	2	7	5	5	7	1	5
5	JAKSARU	3	5	5	2	1	1	9	1	7	7	5	5	1	3
6	SAMUDRABALI	5	7	7	1	1	1	9	3	5	7	5	7	1	1
7	MACHAKANTA	3	7	5	1	1	9	9	2	9	7	5	5	1	3
8	HALDI CHUDI	3	7	5	3	4	1	9	2	9	7	5	7	1	3
9	LIKITIMACHI	5	5	5	6	8	1	9	2	7	7	5	5	3	1
10	Koliha	3	5	5	1	2	1	9	1	3	5	3	7	1	7
11	MALPATRI	3	3	5	1	1	1	9	2	5	5	5	3	1	5
12	GELEI	3	5	5	1	4	1	9	2	5	7	5	5	1	3
13	MAGURA	3	7	5	4	5	1	9	1	7	7	5	5	5	5
14	SUNAMUKI	3	7	5	1	2	1	9	1	7	7	3	3	1	1
15	LOCHEI	5	7	5	1	1	1	9	1	5	7	3	5	1	3
16	KORKOILI	3	5	5	1	1	1	9	1	1	7	3	5	1	7
17	HARISHANKARA	3	7	5	2	5	1	9	2	9	7	3	3	1	5
18	SAMULEI	3	3	5	1	4	1	9	2	5	7	5	7	1	5
19	Bastul	3	5	5	1	1	1	9	2	3	5	3	7	1	5
20	SARSONFUL	5	7	7	4	7	1	9	2	7	7	5	5	3	1
21	SEKTA	3	5	5	1	4	1	9	2	5	5	3	5	1	7
22	PANKAPOTA	3	5	5	1	1	1	9	2	5	5	3	7	1	3
23	DANASARIA	1	5	5	3	4	1	9	2	3	7	3	7	1	7
24	KARANI	3	3	5	6	9	9	9	2	3	7	3	7	1	3
25	LAL GORI	7	7	3	2	5	1	9	3	9	7	5	7	1	5
26	BASPATRI	3	5	7	3	1	1	9	2	5	5	3	5	4	1
27	PUAGLI	3	7	5	1	1	9	9	2	9	7	5	5	1	5
28	CHINGER	3	1	5	6	9	9	9	1	7	5	3	5	1	5
29	KANTA DUMER	3	5	7	1	4	9	9	2	5	3	3	7	1	9
30	KADALIKENDA	3	7	5	1	1	1	9	2	7	7	5	7	1	5
31	KUSUMA	3	3	5	6	9	9	9	2	3	5	3	5	1	7
32	RAMACHANDRA BOITA	3	5	5	5	4	1	9	2	3	5	5	5	1	5
33	MEDI	3	5	5	3	4	1	9	2	7	7	5	7	1	7
34	KALABHUTIA	3	7	5	6	9	1	9	2	9	7	5	7	4	7
35	JUGAL	3	5	5	3	1	1	9	2	3	7	5	5	1	7
36	DUDHSAR	3	5	5	1	1	1	9	2	7	7	5	7		3
37	KELAS	3	5	5	6	9	1	9	1	7	7	5	5	1	3
38	GOVINDBHOG	5	7	5	1	1	1	9	3	5	7		5	1	1
39	CHAMARMANI	5	7	5	2	2	1	9	2	7	7		7	1	
40	NINI	7	1	5	3	3	1	9	2	3	7	7	7	1	5
41	LILAVATI	3	5	5	2	1	1	9	2	7	7	7		1	3
42	SHIULI	1	5	5	2	1	1	9	2	5	5	7	7	1	5
43	BASTABHOG	5	3	5	3	5	1	9	2	5	7	7	5	1	1
44	KALIA	5	3	5	6	9	1	9	2	5	7	7	7	4	1
45	DENGERCHUDI	3	5	5	3	5	1	9	2	7	7	5	3	1	1
46	NAGRA	5	7	5	3	5	1	9	2	7	5	7	7	1	3
47	SENKARA	3	3	5	3	4	9	9	2	3	7	5	5	1	7
48	GHOES	5	7	5	2	2	9	9	2	3	7	7	7	1	5
49	KANAKACHUR	5	7	5	4	4	9	9	2	3	7	5	7	1	5
50	KERALASUNDARI	3	7	5	2	2	1	9	2	7	7	7	7	1	3
51	ASIT KALMA	3	5	5	1	2	9	9	2	3	7	7	7	1	5
52	PORASENKARA	3	3	5	3	4	1	9	1	3	5	5	3	1	5
53	BAHURUPI	3	5	3	3	1	1	9	2	5	5	7	7	1	3
54	RANIKAJAL	5	7	5	6	9	1	9	2	5	7	7	7	4	1
55	BENAPOL	3	7	5	2	2	1	9	2	5	7	5	5	4	3
56	KARPUR BHOG	5	7	7	5	7	1	9	2	9	7	5	5	4	1
57	NINIBUDHI	3	3	5	6	9		9	1	1	7	3	5	1	7
58	BIDAN SAPRU	3	7	3	2	2	1	9	2	7	7	3	5	1	5

S. No	Cultivator	ae	af	ag	ah	ai	aj	ak	al	am	an	ao	ap	aq	ar
		59	LADARI	3	7	5	3	2	1	9	1	7	7	3	5
60	DENGABARI	5	7	5	2	5	1	9	1	9	7	3	3	1	7
61	KUSUMA KUNTALA	3	5	3	5	2	1	9	1	3	5	3	5		7
62	KALAJIRA	5	7	5	6	9	1	9	2	7	7	5	7	4	3
63	KATHIA	3	3	5	5	1	1	9	2	5	5	3	5		5
64	RATANCHUDI	5	7	5	3	5	1	9	2	7	7	5	7	1	3
65	DHABALABHUTA		3	5	3	3	1	9	2	5	7		7	1	5

Flag leaf: Attitude of blade (late observation)-**ae**, Panicle: Curvature of main axis-**af**, Panicle: Number per plant-**ag**, Spikelet: Colour of tip of lemma-**ah**, Lemma and Palea: Colour-**ai**, Panicle: Awns-**aj**, Panicle: Presence of secondary branching-**ak**, Panicle: Secondary branching -**al**, Panicle: Attitude of branches-**am**, Panicle: Attitude of branches-**an**, Panicle: Exertion Time maturity (days)-**ao**, Leaf: Senescence-**ap**, Sterile lemma: Colour-**aq**, Grain: Weight of 1000 fully developed grains-**ar**, Grain: Length-**as**, Grain: Width-**at**, Grain: Phenol reaction of lemma-**au**, Decorticated grain: Length-**av**, Decorticated grain: Width-**ax**, Decorticated grain: Shape (in lateral view)-**ay**, Decorticated grain: Colour-**az**, Endosperm: Presence of amylose-**ba**, Endosperm: Content of amylose Varieties with endosperm of amylose absent only-**bb**, Polished grain: Expression of white core-**bc**, Gelatinization temperature through alkali spreading value-**bd**, Decorticated grain: Aroma-**be**.

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