www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(7): 2211-2214

www.thepharmajournal.com
Received: 05-05-2023
Accepted: 12-06-2023

Understanding the agro-morphological traits of rice accessions for drought stress assessment: A comparative study

Priya Gupta, Jyoti Sahu, Deepak Gauraha, Abhinav Sao, Pooja Kathare and Namita Singh

Priya Gupta
Department of Genetics and Plant Breeding, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Jyoti Sahu
Department of Genetics and Plant Breeding, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Deepak Gauraha
Department of Genetics and Plant Breeding, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Abhinav Sao
Department of Genetics and Plant Breeding, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Pooja Kathare
Ph.D. Research Scholar, Department of Plant Molecular Biology and Biotechnology, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Namita Singh
Department of Genetics and Plant Breeding, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Corresponding Author:
Priya Gupta
Department of Genetics and Plant Breeding, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Abstract
The current study was conducted to characterize DUS of 200 rice germplasm accessions, together with drought responsive checks, which were planted in Augmented Design among four blocks for visually assessed features. Trials were carried out during *Kharif* 2020 at the research cum instructional farm, Department of Genetics and Plant Breeding, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) in an Augmented design with 20 cm 15 cm spacing and recommended cultural practices. This data was collected for twenty-four DUS descriptors. In the current study, one visually observed trait was found to be monomorphic, nine to be dimorphic, and fourteen to be polymorphic. The most variable descriptors were basal leaf: sheath colour, hull colour, and kernel colour, which were shown to have different kinds.

Keywords: DUS characterization, morphological descriptors, germplasm accessions, drought stress

Introduction
Rice is a primary food crop in Asian continent and has a significant impact on the cultures, economy, and diets of millions of people. Recognising its international year of rice was declared to be 2004 emphasising the crop's role in combating malnutrition, poverty, and food insecurity (Sahu *et al*., 2021) [12]. Rice farming has a long history, with evidence reaching back roughly 6,500 years in various Asian countries. Japonica and Indica rice have diverse grain types and are suitable to different climate zones (Dhidhi *et al*., 2021) [3]. Rice has traditionally been grown in flooded areas, with standing water maintained throughout the season. Changes in climatic conditions, such as droughts, have, however, posed substantial hurdles to rice production. Drought stress has a negative impact on rice plants at all phases of development, resulting in lower biomass output, delayed maturity, and lower yield. As drought events become more frequent and severe, producing high-yielding and drought-tolerant rice cultivars is critical for assuring Asian food security. Investigation focusses on drought assessment of rice for morpho-physiological traits and to evaluate their variability and response strategies. This work aimed to contribute to the creation of drought-tolerant rice cultivars, ensuring sustainable rice production in the face of changing climatic conditions.
The research paper focusses on assessment of the germplasm lines to understand the distinctness of the genotypes. A newly developed variety or genotype may be notified only if it meets the criteria of distinctiveness, novelty, stability and uniformity, (Singh *et al*., 2021) [13]. Distinctiveness, Uniformity, and Stability (DUS) characterisation for rice was recently implemented in India. This data contains twenty-nine quantitative and thirty-nine qualitative qualities.

Materials and Methods
An experiment was conducted by DBT, New Delhi acquired 200 rice accessions along with seven checks *viz*; Annada, Swarna, Dagad desi, RRF140, RRF 127, DRR Dhan 142 and MTU 1010 was carried out in Augmented design within four blocks at the research cum instructional farm, Department of Genetics and Plant Breeding, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh). Spacing taken for the study was 20*15 betwenn Rows and Plants. Randome Slecetion of 5 plants was done accessions wise and replication wise to record observations for 19 morphological traits.

Observation, scoring and assessment

Following the criteria of PPV and FRA, 2001, observations were made on 5 plants or plant components per replication of each accession. There are four sorts of assessments. Visual inspection of individual plants or sections of plants (VS), the scoring method used was visual assessment was done for plant parts or group of plants or by measurement of single or group of plants.

Results and Discussion

Rice DUS Characterization of the rice test guideline (UPOV/TG/16/8, 2004) was used for distinctness, uniformity, and stability (DUS) tests on new rice varieties. Article 7 of the UPOV Convention's 1961/1972 and 1978 Acts, as well as Article 12 of the 1991 Act, describe novelty, distinctiveness, uniformity, and stability of a variety. Data were collected on 207 rice accessions for quantitative and qualitative characteristics using the DUS test recommendations (Annada, Swarna, Dagad Desi, RRF140, RRF 127, DRR Dhan 142 and MTU 1010)The qualities evaluated in this study were scored based on visually observed and measurable criteria. ANOVA was used to investigate the quantitative features of those characters.

Phenotypic characterisation

The morphological data was evaluated to identify various genotypes and 19 qualitative features were observed. Table 1 shows the frequency distribution and percentage value of the 19 qualitative qualities evaluated. These characteristics were evaluated visually on individual plants or on groups of plants. Visually assessed features serve an important role in distinguishing a variation from other recognised varieties in the public domain. A variety's distinctiveness is determined by evident and distinct contrasts between the test variety and the reference variety for one or more features that adhere to the test requirements. As being not easily altered by environmental variations, qualitative features are a useful predictor of morphological distinctness. Any variety with persistent and new morphological characteristics can be particularly effective in distinguishing pronounced people. Morphological features are helpful markers when they are novel, distinct, uniform, and pass down to future generations; they can also be employed as dependable markers.

Variability among variables can be detected in their frequency distribution. The following morphological findings were made: 68.1% of coleoptiles were green, while 31.9% were purple. Coleoptile coloration can be used further by breeders for disease resistance as anthocyanin pigment has sometimes been found to enhance resistance against disease or pest, and after further study it can also be used as a genetic marker for any desired trait. Green (64.3%), purple line (21.7%), light purple (0.5%), and uniform purple (13.5%) were the most abundant colours in the basal leaf sheath. This conclusion was also confirmed by Dhidhi *et al.* 2021 [3], Akshay *et al*. (2022) [1], Mundotiya *et al*. (2022) [8]. Based on the leaf distribution of anthocyanin coloration, the accessions were classified as having it just on the tips, on the margins, in blotches, or in uniformity (1.9%, 24.2%, 0.5%, and 73.4%, respectively). Parikh *et al*. (2012) [9], Gour *et al*. (2019) [5] and Gupta *et al.* 2021 [6] support this finding. Anthocyanin pigmentation is found to be important criteria for the distinction of plant parts and accessions. Anthocyanin accumulation is involved in various physiological processes, including hormone response modulation, UV radiation protection, and defensive response to biotic and abiotic stress (Gour *et al*. 2017) [5]. Accessions containing desired characters can be further used for the future breeding development programme (Reddy *et al*. 2008) [11].

Pubescence on the leaf blade surface was strong in 82.1% of the genotypes studied and medium in 17.9%; this result was also confirmed by Mundotiya *et al*. (2022) [8]. Every single individual had leaf auricles. The auricle contained 77.8% colourless anthocyanins, 11.6% purple anthocyanins, and 10.6% light purple anthocyanins. Akshay *et al*. (2022) [1] reported comparable findings. Every genotype studied exhibited a prominent leaf ligule with a split type form; this finding was also supported by Rawte *et al*. (2017) [10], Akshay *et al*. (2022) [1] and Mundotiya *et al*. (2022) [8].

The stigma in spikelets was found to be white in 60.9% and purple in 39.1%. Parikh *et al*. (2012) [9], Gour *et al*. (2019) [5], Akshay *et al*. (2022) [1], and Mundotiya *et al*. (2022) [8] all confirmed this finding. Late analysis of flag leaf blade attitude indicated a wide range, with 6.8, 63.8, 25.6, and 3.9 percent of the population displaying horizontal, semi-upright, erect, and deflated attitudes, respectively. Akshay *et al*. (2022) [1], Sahu *et al.* 2021 [12] and Mundotiya *et al*. (2022) [8] found similar results. The angles of the flag leaf, according to Fonseca *et al.* (2002) [4], are unique to the cultivar and are rarely affected by the environment. Awns were found in 8.2% of the population, with short awns accounting for 36.8%, long awns accounting for 21.5% and very long awns accounting for 42.11%. Awn was found in 57.9% of the population's upper half and 42.1% of the population's entire length. This finding was supported by Akshay *et al*. (2022) [1] and Mundotiya *et al*. (2022) [8]. According to Gour *et al*. (2019) [5], Awns presence is important feature for a physiologist as it help in extra physiological use for photosynthesis but farmers finds it a hindrance while threshing. Panicle exertion was low in 34.8%, partial in 3.4%, predominant in 4.3%, and high in 57.5%. Dhidhi *et al.* 2021 [3], Mundotiya *et al*. (2022) [8] agreed with this finding.

All 207 genotypes exhibited secondary branching, with weak secondary branching appearing in 8.2% of cases, strong secondary branching appearing in 80.5% of cases, and clustered secondary branching appearing in 6.8% of cases. Genotypes containing short panicle types can be used in breeding program according to the observations obtained to increase rice production. Chakrabarty *et al*. (2012) [14], Rao *et al*. (2013) [15], Gour *et al*. (2019) [5], and Akshay *et al*. (2022) [1] all reached similar conclusions. Leaf senescence was early in 37.7% of the population, medium in 55.1%, and late in 7.2%. Grain length was 1.4% very short, 67.1% short, 30.4% medium, and 1.0% long. Grain breadth was very narrow in 1.9% of the population, narrow in 48.3%, medium in 54.1%, and broad in 5.3%. Akshay *et al*. (2022) [1] reached a similar conclusion. Hull colour was straw 72.9% of the time, golden furrow in straw backdrop 8.2% of the time, brown furrows on straw 7.2% of the time, brown spots in straw background 5.8% of the time, brown (tawny) 1.4% of the time, purple furrow 3.4% of the time, and purple black 0.96 percent of the time. Akshay *et al*. (2022) [1] discovered a similar finding. The coloration of the kernels was white in 78.3%, light brown in 14.5%, dark brown in 6.3%, and red in 1%. Lemma colour was straw 99.5 percent of the time and red 0.5 percent of the time (IC516693). Akshay *et al*. (2022) [1] and Mundotiya *et al*. (2022) [8] found similar results. Aroma was discovered in only one accession (IC390636). This form of uniqueness, according to DUS guidelines, can be used for further candidate variety development (Kumawat *et al*., 2022) [7]. The coloration of the apiculus was straw in 68.1%, purple in 27.55%, and red in 4.3%. Akshay *et al*. (2022) [1] discovered a similar finding. Threshability was medium for 6.8 percent of the population, with the remainder readily threshed. The study showed considerable amount of differences among the accessions which was also corroborated by Chakrabarty *et al*. (2012) [14], Gour *et al*. (2019) [5], and Singh *et al*. (2021) [13].

Table 1: Characterisation of DUS descriptors

Descriptors	Visual observations	Occurrence	Percent contribution
Colour of coleoptile	Green	141	68.1
	Purple	66	31.9
Seedling vigour	Germination	188	91
	Vigour	19	9
Basal leaf: Sheath colouration	Green	133	64.3
	Light purple	1	0.5
	Purple line	45	21.7
	Uniform purple	28	13.5
Leaf blade anthocyanin coloration	Light green	153	74.0
	Purple margin	50	24.0
	On tip	4	2.0
Anthocyanin distribution in leaf blade	On tips only	4	1.9
	On margins only	50	24.2
	In blotches only	1	0.5
	Uniform	152	73.4
Pubescence of leaf blade	Medium	37	17.9
	Strong	170	82.1
Leaf: Anthocyanin colouration of auricles	Colourless	161	77.8
	Light purple	24	11.6
	Purple	22	10.6
Leaf: Shape of ligule	Split	207	100.0
Spikelet: Colour of stigma	White	126	60.9
	Purple	81	39.1
Flag leaf: Attitude of blade(Late observation)	Erect	53	25.6
	Semi-erect	132	63.8
	Horizontal	14	6.8
	Deflexed	8	3.9
Panicle: Awn	Absent	190	91.8
	Present	17	8.2
Panicle: Length of longest awn	Short	7	36.8
	Long	4	21.5
	Very long	8	42.11
Panicle: Distribution of awn	Upper half	11	57.9
	Whole length	8	42.1
Panicle: Exertion	Just	72	34.8
	Partially	7	3.4
	Mostly	9	4.3
	Well	119	57.5
Panicle: secondary branching	Weak	17	8.2
	Strong	176	85.0
	Clustered	14	6.8
Leaf: Senescence	Early	78	37.7
	Medium	114	55.1
	Late	15	7.2
Grain: Length	Very short (<6.0 mm)	3	1.4
	Short (6.1-8.5cm)	139	67.1
	Medium(8.6-10.5 cm)	63	30.4
	Long (10.6-12.5 cm)	2	1.0
Grain: Breadth	Very narrow(<2.0cm)	4	1.9
	Narrow (2.1- 2.5 cm)	100	48.3
	Medium (2.6-3.0 cm)	112	54.1
	Broad (3.1-3.5 cm)	11	5.3
Aroma	Present	1	0.5
	Absent	206	99.5
Hull colour	Straw	151	72.9
	Golden furrow in straw background	17	8.2
	Brown furrows on straw	15	7.2
	Brown spots on straw background	12	5.8

	Brown (tawny)	3	1.4
	Purple furrow on straw	7	3.4
	Purple black	2	0.96
Kernel colour	White	162	78.3
	Light brown	30	14.5
	Variegated brown	0	0.0
	Dark brown	13	6.3
	Red	2	1.0
Lemma colour	Straw	206	99.5
	Red	1	0.5
Apiculus colour	Straw	141	68.1
	Purple	57	27.5
	Red	9	4.3
Thresh ability	Easy	193	93.2
	Medium	14	6.8

Conclusion
Early maturity and drought tolerant genotypes will be produced through selection in these genotypes, which will prove to have a tremendous usefulness for global acceptance for these accessions. The results obtained will be useful for the future studies enhancement of the rice crop, development in the field of more abiotic stress management breeding projects so as have quick adaption for the changing environmental conditions and food shortage in respect to the growing population.

Reference

1. Akshay M, Chandra BS, Devi KR, Hari Y, Vamshi P. DUS characterization of traditional varieties and advanced cultivars of rice using 29 essential characters. Association of rice research workers; c2022. p.157.
2. Banshidhar PJ, Singh MK, Deo I. DUS Characterisation of Advanced Recombinant Lines of Kalanamak Rice (*Oryza sativa* L.) Using Morphological Descriptors and Quality Parameters.
3. Dhidhi S, Gauraha D, Sarawgi AK, Sao A. Genetic variability studies for yield and yield components in rice (*Oryza sativa* L.). The Pharma Innovation J. 2021;10(10):1057-1059.
4. Fonseca Jr, Cutrim Va, Rangel Phn. Agronomic and phenological morphological descriptors of commercial rice paddy cultivars. Brasília, DF: Embrapa; c.2002. p. 22.
5. Gour L, Koutu GK, Singh Y, Singh SK. Characterization and grouping of indigenous rice lines based on DUS test for different qualitative differentials. Pharma Innov J. 2019;8(4):1162-1168.
6. Gupta S, Gauraha D, Sao A, Chaudhary PR. Assessment of genetic variability, heritability and genetic advance in accessions of rice (*Oryza sativa* L.). The Pharma Innovation Journal. 2021;10(6):1231-1233.
7. Kumawat P. Conglomeration of farmers' varieties of rice in Madhya Pradesh using DUS guideline by PPV&FR; c2022.
8. Mundotiya SK, Goyanka J, Mundotiya RK, Swami SR. Constraints in visual DUS characterization and differentiation of rice (*Oryza sativa* L.) cultivars; c2022
9. Parikh, M, Motiramani NK, Rastogi NK, Sharma B. Agro-morphological characterization and assessment of variability in aromatic rice germplasm. Bangladesh Journal of Agricultural Research. 2012;37(1):1-8.
10. Rawte SUMAN, Saxena RR, Sahu HEMANT, Verulkar SB. Study of agro morphological variation of rice (*Oryza sativa* L.) germplasm collected from different parts of Chhattisgarh. Trend in Biosci. 2017;10(11):2078-2086.
11. Reddy RN, Mohan SM, Madhusudhana R, Umakanth AV, Satish K, Srinivas G. Inheritance of morphological characters in sorghum; c2008.
12. Sahu LP, Vageeshvari DPC, Gauraha D. Diversity analysis of rice (*Oryza sativa* L.) germplasm accessions using principal component analysis; c2021.
13. Singh B, Gauraha D, Sao A, Nair S. Assessment of genetic variability, heritability and genetic advance for yield and quality traits in advanced breeding lines of rice (*Oryza sativa* L.). The Pharma Innovation. 2021;10(8):1627-1630.
14. Chakrabarty S, Bharati P. Household economy and nutritional status among the Shabar tribe living in a protected forest area of Orissa, India. Human Biology Review. 2012;1(1):22-37.
15. Rao KT, Rao AU, Sekhar D. Effect of sources and levels of sulphur on groundnut. Journal of Academia and Industrial Research. 2013 Oct;2(5):268-70.