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Assessment of variability of rice (*Oryza sativa* L.) germplasm using agro-morphological characterization

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Abstract
Investigation was undertaken at Crop Research Station, (ANDUAT) Masodha during 2019 to study the performance of various rice genotypes. The present study was carried out to characterize nine hundred seventy five rice germplasm accessions on the basis of twenty-nine morphological and eight agronomical traits. Most of the morphological characters showed variation in different accessions except leaf: collar leaf: ligule and leaf: shape of ligule. A significant amount of variation was displayed for most of the agronomical traits examined. After evaluation of 975 accessions for eight quantitative characters, on the basis of mean values, top ten accessions were identified for the yield and ancillary traits. These can be used to identify phenotypically divergent sources for traits of interest in breeding programmes.

Keywords: agro-morphological characters, germplasm, variability, rice, phenotypically

Introduction
Rice (*Oryza sativa* L.) is the world's most important food crop belongs to Poaceae. It serves as the staple food for more than half of the globe's population (khan *et al.*, 2013). Rice is the second most important crop which brings economic prosperity of the growers as well as earns billions of rupees through its export for country. Rice is the third highest produced cereal after wheat and maize (FAOSTAT, 2012) [9]. It is the main staple food for about 50% of the world's population, especially in developing countries (FAO, 2017) [9]. By the year 2025, global demand for rice will be 880 million tonnes compared to the current world production of 470 million tonnes of milled rice (IRRI, 2010). The average growth rate of rice yield was 3.68% annually in the 1980s, but it decreased to 0.75% per year in the late1990s and rice productions are still low in the world (FAO, 2017) [9]. In years to come, expanding the areas of rice cultivation will be limited because of land and water resource scarcity due to climate changes, urbanization and population growth. Pressure from biotic and abiotic factors, declining productivity in intensive rice production systems, increasing the cost of production and low yielding varieties are some of the factors responsible for the low yield of rice obtained by farmers. The large scale spread of modern, high yielding varieties has replaced the traditional varieties especially in the irrigated rice ecosystem leading to reduced genetic base and thus increased genetic variability. In past few decades, increase in share of high yielding varieties and shrinkage in the area of local varieties have been reported in India (Hore 2005; Rana *et al.*, 2009) [17] as well as in several other countries (Chaudhary *et al.*, 2006; Itani 1993) [5, 12]. There is an urgent need to broaden the genetic base of the important crop by introgressing genes from diverse sources. Breeding for rice varieties that produces higher yields of grain per unit land area is crucial to achieving increased rice production especially because of reduction in the land available for rice cultivation (Paterson *et al.*, 2005) [6]. The effectiveness of any rice improvement programme depends on the utilization of different germplasm around the world (Susan *et al.*, 2012) [18]. These germplasm can only be utilized optimally by breeders if it is well characterized. Therefore, the objective of this study was to characterize a set of rice germplasm collected from eastern Uttar Pradesh analyzed the agro-morphological traits.

Material and Methods
The experiment was conducted during WS 2017, 2018 and 2019 at Crop Research Station, Masodha, which is situated at 26.47^{0}N (latitude), 82.12 ^{0}E (longitude) and at 113 m (altitude). Soil of the experimental field is sandy loam with pH 7.2, organic carbon 0.40%. Crop nursery was grown in raised beds and twenty three days old seedlings were transplanted in the first

week of July. The recommended dose of fertilizer (RDF) for the ecology is 120:60:60:25 N P K $ZnSO_4$ kg/ha. To control weeds, Rift @ 1.25 litre/ha was applied just after transplanting. The material for the present investigations consisted of 975 rice accessions received from different district of Eastern Uttar Pradesh and was evaluated under germplasm evaluation trial. Each entry was sown in a plot comprising three rows having three meter length at spacing of 20 cm between rows and 15 cm between plants. Observations were recorded on five randomly chosen plants of each accession for thirty-seven morphological and agronomical traits. The traits studied were Basal leaf: sheath colour, Leaf: intensity of green colour, Leaf: anthocyanin colouration, Leaf sheath: anthocyanin colouration, Leaf sheath: intensity of anthocyanin colouration, Leaf: pubescence of blade surface, Leaf: auricles, Leaf: anthocyanin colouration of auricles, Leaf: collar, Leaf: anthocyanin colouration of collar, Leaf: ligule, Leaf: shape of ligule, Leaf: colour of ligule, Culm: attitude, time of 50% heading, Flag leaf: attitude of blade, Lemma: anthocyanin colouration of keel, Lemma: anthocyanin colouration of area below Apex, Lemma: anthocyanin colouration of apex, Spikelet: colour of stigma, Stem: length, Stem: anthocyanin colouration of nodes, Stem: intensity of anthocyanin colouration of nodes, Stem: anthocyanin colouration of internodes, Panicle: length of main axis, Panicle: curvature of main axis, Panicle: number per plant, Lemma and palea: colour, Panicle: awns, Panicle: presence of secondary branching, Panicle: attitude of branches, Panicle: exsertion, days to maturity and Grain yield/plant. Accessions were characterized using morpho-agronomic descriptors according to DUS guidelines (DRR, 2006). Frequency distribution was computed to categorize the accession into different classes. Simple statistics (means, ranges) was calculated to have an idea of the level of variation.

Results and Discussion

Qualitative characters are important for plant description (Kurlovich, 1998) [14] and mainly influenced by the consumers preference, socioeconomic scenario and natural selection (Hien *et al.*, 2007). Frequency distribution for 29 qualitative traits is depicted in Table 1 and its graphical representation of frequency distribution showed in Figure 1. Most of the morphological characters showed variation in different accessions except Leaf: collar, Leaf: ligule and Leaf: shape of ligule. A majority of accessions were found to possess Basal leaf: sheath colour (85% green), Leaf: intensity of green colour (75% medium), Leaf: anthocyanin colouration (87% absent), Leaf sheath: anthocyanin colouration (90% absent), Leaf sheath: intensity of anthocyanin colouration (60% very weak), Leaf: pubescence of blade surface (63% medium), Leaf: auricles (99% present), Leaf: anthocyanin colouration of auricles (59% light purple), Leaf collar (99.9%), Leaf: anthocyanin colouration of collar (93% absent), Leaf: ligule (99.9%), Leaf: shape of ligule (100% Cleft/split), Leaf: colour of ligule (56% light purple), Culm: attitude (73% semi erect), Flag leaf: attitude of blade (46% semi erect), Lemma: anthocyanin colouration of keel (75% absent/very weak), Lemma: anthocyanin colouration of area below Apex (83% absent), Lemma: anthocyanin colouration of apex (67% absent), Spikelet: colour of stigma (74% white), Stem: length (excluding panicle, excluding floating rice (34% medium), Stem: anthocyanin colouration of nodes (86% absent), Stem: intensity of anthocyanin colouration of nodes (53% medium), Stem: anthocyanin colouration of internodes (91% absent), Panicle: curvature of main axis (51% semi erect), Panicle: number per plant (68% few), Lemma and palea: colour (61% straw), Panicle: awns (93% absent), Panicle: presence of secondary branching (97% present), Panicle: attitude of branches (56% semi erect to spreading) and Panicle: exsertion (75% mostely exserted) Similar type of work was also reported by (Bisne and Sarawgi 2008) and (Moukoumbi *et al.* 2011) [15].

Rice accessions were evaluated for agronomical traits *viz*., days to 50% heading, Stem: length, Panicle: length of main axis, Panicle: number per plant, days to maturity, Grain yield g/m2, from five competitive plants of middle row of each entry. Almost 50% of the lines fall in the range of medium to late group (Fig. 2), Time of heading, 50% of plants with panicles (38% medium).

Plant height had wider range (60-190 cm) of variation with a mean value of 156 cm. (Ali *et al.* 2000) have observed relatively greater range in plant height than the other characters. Plant height in rice is a complex character and is the end product of several genetically controlled factors called internodes (Cheema *et al.*, 1987) [6]. Hera (60 cm) and Jaldi dhan (62 cm) were the two accessions which falls under very dwarf group. More than 50% accessions were having plant height in the range of 131-150 cm and can be grouped as tall. Very few accessions exhibited semi dwarf nature and about 100 accessions showed semi tall stature. Reduction in plant height may improve their resistance to lodging and reduce substantial yield losses associated with this trait (Abbasi *et al.*, 1995) [1].

Panicle length has exhibited reasonable amount of variation with range values of 17-32 cm. The average panicle length was 28 cm. Most of the accessions fall under the range of 26-30 cm panicle length. The maximum panicle length was observed in Gajraj, although it contributes positively and maximum panicle length is not the only factor responsible for higher grain yield (Abbasi *et al.*, 1995) [1]. So panicle length alone does not determine the high grain yield as traits such as grain size, grain shape, higher number of tillers/plant, longer panicles and greater number of grains/panicle ultimately contribute to higher grain yield (Akram *et al.*, 1994) [2].

Days to maturity: It also exhibited high range (65-160 days) with a mean of 129 days Hera had shorter maturity period (65 days) representing earliness. Minimum value for days to maturity represents that the variety has a benefit of early ripening. Most of the lines fall under mid early followed by medium and late duration.

Grain yield g/m2:43% rice genotypes of medium grain yield. Very high yield is Neebu 24g/plant followed by Gajraj 23g/plant, Sonkachra 22g/plant.

After evaluation of 975 accessions identifying germplasm accessions for different agronomical characters in phenotypically divergent sources would help in pre-breeding and breeding programs.

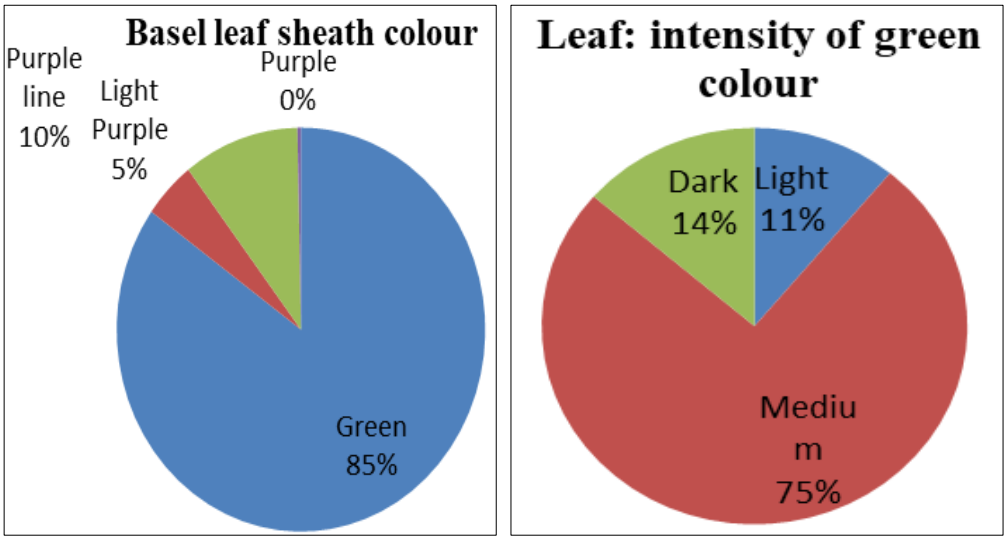

Fig 1: Frequency distribution of important morphological characters

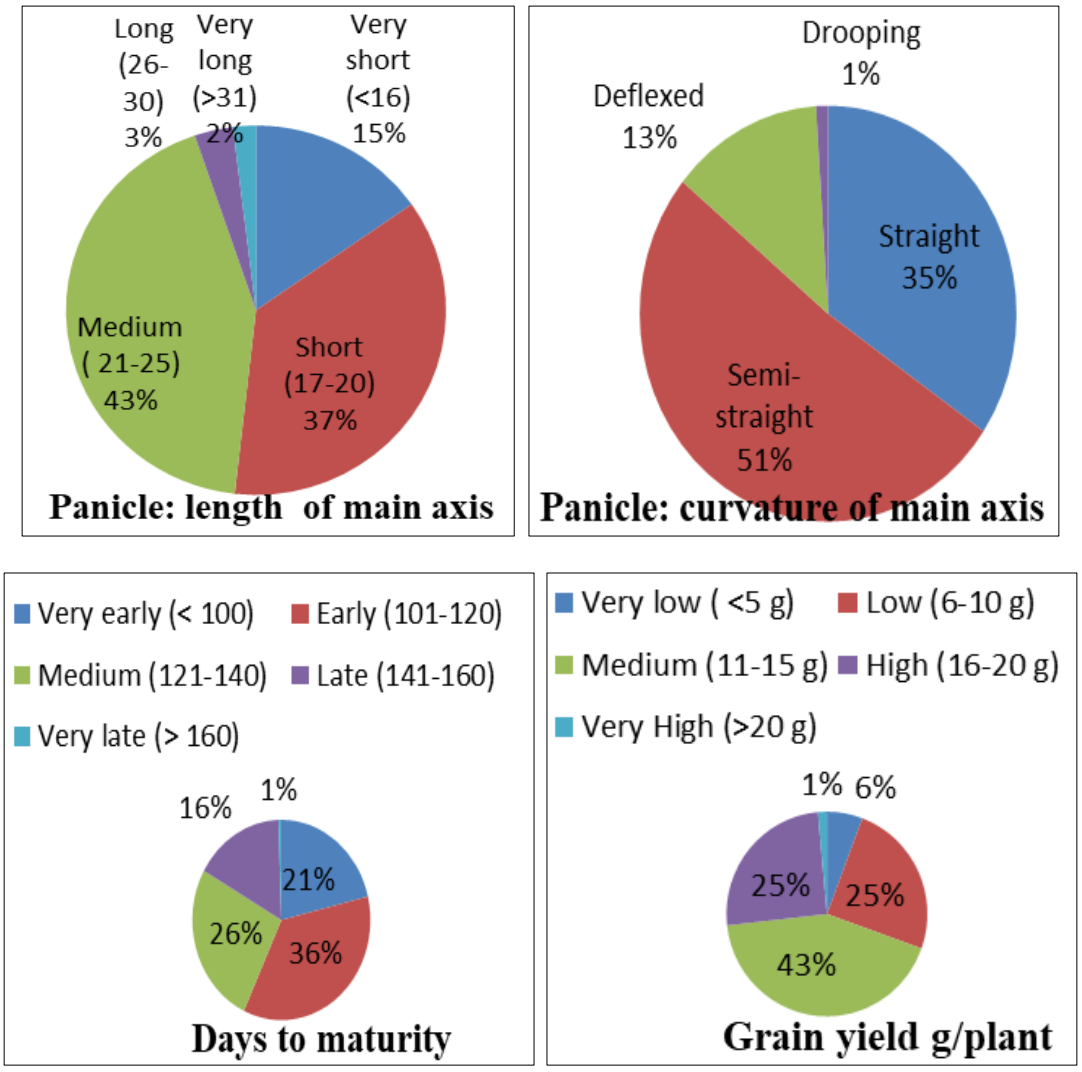

Fig 2: Frequency distribution of yield and contributing traits

Table 1: Frequency distribution for agro-morphological characters

Sl No.	Morphological characters	Colour pattern/ type	Frequency
1-	Basal leaf: sheath colour	Green	828
		Light Purple	45
		Purple line	99
		Purple	3
2-	Leaf: intensity of green colour	Light	107
		Medium	735
		Dark	133
3-	Leaf: anthocyanin colouration	Absent	848
		Present	127
4-	Leaf sheath: anthocyanin colouration	Absent	873
		Present	102
5-	Leaf sheath: intensity of anthocyanin colouration	Very weak	587
		Weak	124
		Medium	115
		Strong	123
		Very strong	26
6-	Leaf: pubescence of blade surface	Absent	19
		Weak	76
		Medium	529
		Strong	331
		Very strong	39
7-	Leaf: auricles	Absent	7
		Present	968
8-	Leaf: anthocyanin colouration of auricles	Colourless	311
		Light Purple	613
		Purple	51
9-	Leaf: collar	Absent	1
		Present	974
10-	Leaf: anthocyanin colouration of collar	Absent	903
		Present	72
11-	Leaf: ligule	Absent	1
		Present	974
12-	Leaf: shape of ligule	Truncate	0
		Acute	0
		Cleft/split	975
13-	Leaf: colour of ligule	White	415
		Light Purple	549
		Purple	10
14-	Culm: attitude	Erect	79
		Semi erect	711
		Open	179
		Spreading	6
15-	Days to heading (50% of plants with panicles)	Very early (<71)	11
		Early (72-90)	362
		Medium (91-130)	373
		Late (131-145)	215
		Very late (>145)	14
16-	Flag leaf: attitude of blade (early observation)	Erect	271
		Semi erect	444
		Horizontal	236
		Drooping	24
17-	Lemma: anthocyanin colouration of keel	Absent/ very weak	729
		Weak	49
		Medium	56
		Strong	66
		Very strong	75
18-	Lemma: anthocyanin colouration of area below Apex	Absent	813
		Weak	26
		Medium	38
		Strong	42
		Very strong	56
19-	Lemma: anthocyanin colouration of apex	Absent	656
		Weak	78
		Medium	59
		Strong	67
		Very strong	115

20-	Spikelet: colour of stigma	Whight	726
		Light green	3
		Yellow	125
		Light Purple	56
		Purple	65
21-	Stem: length (excluding panicle, excluding floating rice	Very short (<91)	256
		Short (91-110)	299
		Medium (111-130)	329
		Long (131-150)	75
		Very long (>151)	16
22-	Stem: anthocyanin colouration of nodes	Absent	843
		Present	132
23-	Stem: intensity of anthocyanin colouration of nodes	Weak	369
		Medium	519
		Strong	87
24-	Stem: anthocyanin colouration of Internodes	Absent	887
		Present	88
25-	Panicle: length of main axis	Very short (<16)	149
		Short (17-20)	356
		Medium (21-25)	419
		Long (26-30)	32
		Very long (>31)	19
26-	Panicle: curvature of main axis	Straight	337
		Semi-straight	501
		Deflexed	127
		Drooping	10
27-	Panicle: number per plant	Few (<11)	667
		Medium (11-20)	301
		Many (> 20)	7
28-	Lemma and palea: colour	Straw	597
		Gold and gold furrow on straw	79
		Brown spots on straw	9
		Brown furrow on straw	201
		Brown (Tawny)	19
		Reddish to light purple	13
		Purple spots/furrow on straw	7
		Purple	39
		Black	11
29-	Panicle: awns	Absent	903
		Present	72
30-	Panicle: presence of secondary branching	Absent	27
		Present	948
31-	Panicle: attitude of branches	Erect	9
		Erect to semi erect	15
		Semi erect	76
		Semi erect to spreading	549
		Spreading	326
32-	Panicle: exsertion	Partly exserted	111
		Mostly exserted	725
		Well exserted	136
33-	Days to maturity	Very early (< 100)	207
		Early (101-120)	348
		Medium (121-140)	256
		Late (141-160)	159
		Very late (> 160)	5
34-	Grain yield g/plant	Very low (<5 g)	56
		Low (6-10 g)	241
		Medium (11-15 g)	417
		High (16-20 g)	247
		Very High (>20 g)	14

References

1. Abbasi FM, Sagar MA, Akram M, Ashraf M. Agronomic and quality traits of some elite rice genotypes. Pakistan Journal of Scientific and Industrial Research 1995;38:348-350.
2. Akram M, Abbasi FM, Sagar MA, Ashraf M. Increasing rice productivity through better utilization of germplasm. In: Proc. of a Nat. Semi. On Genetic Resources of Cereals and their Utilization. Islamabad, Pakistan 1994, 107-14.
3. Ali SS, Jafri SJH, Khan TZ, Mahmood A, Butt MA. Heritability of yield and yield components of rice. Pakistan Journal of Agricultural Research 2000;16:89-91.
4. Bisne R, Sarawgi AK. Agromorphological and quality

characterization of badshah bhog group from aromatic rice germplasm of Chhattisgarh. Bangladesh Journal of Agricultural Research 2000;33:479492.
5. Chaudhary P, Gauchan D, Rana RB, Sthapit BR, Jarvis DI. Potential loss of rice landraces from a terai community in Nepal: a case study from Kachorwa, Bara. PGR Newsletter 2006;137:14-21. Hore,
6. Cheema AA, Awan MA, Iqbal J. Improvement of Plant Height Architecture in Basmati Rice. Pakistan Journal of Agricultural Research 1987;8:371-4.
7. DK. Rice diversity collection, conservation and management in northeastern India. Genetic Resources and Crop Evolution 2005;528:1129-1140.
8. Efendi Kesumawaty E, Zakaria S, Bakhtiar Syafruddin. Morphagronomic performance of rice (*Oryza sativa* L.) landraces under organic cultivation of SRI methods. International Journal of Agricultural Research 2015;10(2):74-82. https://scialert.net/fulltext/?doi=ijar.2015.74.82.
9. Food and Agricultural Organisation (FAO). Rice information. Food and Agricultural Organisation of the United Nations, Rome, Italy 2017;19(2):20-27. FAOSTAT (2012).
10. Food and Agricultural Organization of the United Nations, Rome Italy, Statistical Data Base http://faostat.fao.org [Accessed 2017 January 12].
11. IRRI. Annual Report for 2009. International Rice Research Institute, Los Banos, Laguna, Philippines 2010, 179-181.
12. Itani T. History, cultivation and breeding of aromatic rice varieties. Bull Hiroshima Prefect Univ 1993;5:267-281.
13. Khan AS, M Imran, Ashfaq M. Estimation of Genetic Variability and Correlation for Grain Yield Components in Rice (*Oryza sativa* L.). American-European J Agric Environ Sci 2013;6:585-590.
14. Kurlovich BS. Species and intraspecific diversity of white, blue and yellow lupins. Plant genetic Resource Newsletters 1998;115:23-32.
15. Moukoumbi YD, Sie M, Vodouhe R, N'dri B, Toulou B, Ogunbayo SA *et al.* Assessing phenotypic diversity of interspecific rice varieties using agro morphological characterization. Journal of Plant Breeding and Crop Science 2011;3(5):74-86.
16. Paterson AH, Freeling M, Sasaki T. Grains of knowledge: Genomics of model cereals. Genome Research 2005;15:1643-1650.
17. Rana JC, Negi KS, Wani SA, Saxena S, Pradheep K, Kak A *et al.* Genetic resources of rice in the Western Himalayan region of India: current status. Genetic Resources and Crop Evolution 2009;56:963-973.
18. Susan RM, Kenneth LM, Wen W, Ruaraidh SH. Genomics of gene banks: A case study in rice. American Journal of Botany 2012;99(2):407-423.