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Morphological characterization of Quantitative Traits and Estimation of Dormancy Period in Promising Rice Varieties (*Oryza sativa* L.) of Telangana State

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ABSTRACT: Among the 15 rice varieties studied, variations were observed for the quantitative morphological characters *viz*., leaf length, stem thickness, stem length, panicle length of main axis, panicle number plant^{-1}, 1000 grain weight, grain length, grain width, decorticated grain length, decorticated grain width, time of heading and maturity. No variations were observed for the characters endosperm amylose content and leaf width. Long leaf blade length is recorded in the variety WGL 915. Medium stem thickness is observed in JGL 18047 and KNM 1638. The length of the main axis of the panicle in the variety WGL 962 is categorized as short while long in RNR 15435 and WGL 915. The varieties JGL 18047, KNM 1638, KNM 733, KNM 118, Tellahamsa and RNR 21278 are categorized as early for days to heading. Even though for endosperm amylose content all the varieties fallen under medium category, the variety WGL 739 is recorded highest amylose content (24.5%) whereas, the variety KNM 118 is recorded the lowest amylose content (20.7%). For the dormancy studies in 15 rice varieties, no dormancy was recorded in Tellahamsa whereas; RNR-11718 exhibited the longest period of dormancy (45 days). The remaining rice varieties exhibited dormancy period from 19 days to 45 days. The highest % of fresh seed germination was recorded in WGL-962 (96.0%) followed by RNR-15048 (95.0%) while the lowest was recorded in RNR-15435 (85.3%). RNR-29325 has recorded the highest initial seedling vigor index-I (2516) while KNM 118 has recorded the lowest (1843). JGL-24423 recorded maximum initial seedling vigour index-II (9312) followed by Tellahamsa (8619) and JGL-18047(8363). Among the rice varieties studied JGL-24423 has recorded good seedling vigour index-I and II.

Keywords: Rice, dormancy, germination, vigour index.

INTRODUCTION

In India, rice is cultivated in an area of 43.66 million ha with a productivity of 2722 kg ha^{-1}. India ranks first in the area and second in production after China (India Stat, 2019-2020) and in newly formed Telangana state rice is cultivated in an area of 32.15 lakh hectares with the production and productivity of 19.361 million tones and 6093kg ha^{-1}respectively (Directorate of Economics and statistics, Hyderabad, 2020). The quantum jump in area, production and productivity was possible due to the release and adoption of short duration varieties in the state since 2014 as compared to 14.15 lakh hectares, 7.121 million tones, 5093 kg ha^{-1}, area, production, productivity respectively during 2014-2015 (Directorate of Economics and statistics, Hyderabad, 2020). Professor Jayashankar Telangana State Agricultural University (PJTSAU) has recently released a good number of promising and outstanding paddy varieties which were very popular among the farmers. The Telangana State is also endowed with excellent agro-climatic conditions, irrigation facilities that were suitable for paddy seed production in both *kharif* and *rabi* seasons.

Varietal characterization is an important criterion for registration of newly developed varieties as it ensures varietal identification by the plant breeders and ultimate consumers and further helps in maintaining genetic purity and identity of variety during various stages of seed production. The aspect of Distinctness, Uniformity and Stability (DUS) is fundamental for characterization of varieties. Accurate identification of varieties is not only a pre requisite for DUS testing, but is critical for the production of quality seed also. The present day rice varieties in different categories either in short, medium and long slender group have similar grain types which are very difficult to distinguish either by using morphological traits of the plant or by using seed characters or even they may not be separated during the seed processing also. Use of same mechanical harvester for different varieties is also one of the major factors for varietal admixtures. Due to shortage in the production of nucleus seed of most popular varieties under contingent conditions the breeder seed is used for production of breeder seed in the multiplication chain which might be one of the reasons for varietal deterioration also.

While grow out test is preferred for hybrids, now a days it is also advisable to conduct for varieties as there are many issues related to quality particularly in varieties with similar grain types. The use of morphological differences between varieties and identification of off types is always apparent and cannot be recognized easily as the varieties look phenotypically similar. We have characterized using all the DUS characters for the rice varieties under study. In this paper we are discussing the quantitative morphological characters along with their dormancy periods.

The seed dormancy can be defined as the state or a condition in which seeds are prevented from germinating even under the favorable environmental conditions for germination. During seed maturation primary dormancy is induced (Graeber *et al*. 2012; Holdsworth *et al*. 2008; Hong *et al*. 2015). Almost all cereal seeds are having fresh seed dormancy immediately after harvest and the seeds will not germinate if we want to use them for sowing immediately for next season. Seed dormancy is a boon in agriculture as it prevents the seeds from sprouting in the field, if wet weather prevails during the time of harvest, thereby retains seed quality by avoiding pre harvest sprouting (Sugimoto *et al*., 2010; Nonogaki *et al*., 2014; Ashkawa *et al*., 2014). It can be a bane when it is necessary to sow successive generations immediately after harvest. Hence the present investigation aimed to identify fresh seed dormancy period of paddy varieties developed from Professor Jayashankar Telangana State Agricultural University (PJTSAU).

Several factors associated with dormancy in rice and Mikkelsen (1967) reported that dormancy in rice is not true embryo dormancy, since embryos excised from dormant seed germinate freely. Seshu and Sorrells (1986) investigated, how to impose dormancy in rice and found that the hull and the pericarp act independently and hull-imposed dormancy in rice is more prolonged than pericarp-imposed dormancy. Roberts (1961) reported impermeability of the hull and the pericarp concerned with the non-availability of oxygen to the embryo or high peroxidase activity (Navasero *et al*., 1975). Takahashi, (1967) figured out, the occurrence of growth inhibitors such as ABA (Gu *et al*., 2011; Baskin and Baskin 2004) and phenols in the covering structures responsible for seed dormancy in rice, (Hartman *et al*. 2011) or might be due to short-chain saturated fatty acids (SCSFAs) (Majumder *et al*., 1989). The present investigation on morphological characterization of quantitative traits and estimation of dormancy period in 15 rice varieties were carried out.

METHODOLOGY

The present investigation was carried out during *Kharif,* 2020 using fifteen elite rice varieties. The breeder seed of 15 rice varieties was obtained from different Rice Research Stations *viz*., Regional Agricultural Research Station, Jagtial (JGL-24423, JGL-18047), Regional Agricultural Research Station, Warangal (WGL-44, WGL-915, WGL-739, WGL-962), Agricultural Research Station, Kunaram (KNM-733, KNM-118, KNM-1638) and Rice Research Centre, Rajendranagar (RNR-11718, RNR-21278, RNR-15435, RNR-15048, RNR-29325 and Tellahamsa) of Professor Jayashankar Telangana State Agricultural University. The nursery was sown during the last fortnight of June and transplanted during the last week of July, 2020 in Randomized Block Design with three replications at seed production area of Seed Research and Technology Centre, Rajendranagar, Hyderabad. Each variety was transplanted in twenty rows of 6m length with the Plot size of 30m^2. All the recommended agronomic practices were followed for crop cultivation and need based crop protection measures were adopted. The data collection on morphological characteristics was initiated from the seedling stage itself. Five plants were randomly selected for each variety in each of the three replications. The data on morphological characters were recorded at different crop growth stages as per the DUS (Distinctness, Uniformity, and Stability) characteristics. The crop was harvested manually in the month of November, 2020 the seed was threshed and dried to the safe moisture limits. From the 3rdday of the harvest, the seeds of all the fifteen varieties were subjected to germination test for every alternate day till the seed reaches above ninety percent germination for finding the dormancy period.

***Procedure for analysis of amylose content of endosperm*:** The simplified procedure of Juliano (1971) is used for the amylose content analysis. Twenty wholegrain milled rice is ground. 100 mg of rice powder is put into a 100 ml volumetric flask and 1 ml of 95% ethanol and 9 ml of 1N Sodium hydroxide are added. The contents are heated on a boiling water bath

to gelatinize the starch. After cooling for one hour, distilled water is added and contents are mixed well. For each set of samples run, low, intermediate and high amylose standard varieties are included to serve as checks. 5 ml of the starch solution is put in a 100 ml volumetric flask with a pipette. 1 ml of 1 N acetic acid, 2 ml of iodine solution (0.2 g iodine and 2.0 g potassium iodide in 100 ml of aqueous solution) is added and volume is made up with distilled water. Contents are shaken well and let stand for 20 minutes. Absorbance of the solution is measured at 620 nm with a spectrophotometer. Amylose content is determined by using a conversion factor and the results are expressed on a dry weight basis.

***Standard germination test*:** The germination test was conducted in laboratory using between paper methods (ISTA, 2019). One hundred seeds in each of four replications were placed on germination paper towels, which were then rolled. The rolled towels were kept in walk in seed germination chamber maintained at 25 ± 1ºC with 90 percent relative humidity. The seedlings were evaluated on the 14th day, and the percent of germination was expressed based on normal seedlings, evaluation was conducted according to He *et al*. (2019). In order to study the seed dormancy period, freshly harvested seeds were kept for germination at an interval of every 2 days subsequently till it reaches standard germination percentage.

Seedling Vigour Index (SVI): Ten seedlings from each replication were selected at random on the 14th day after germination and seedling length was measured. The same seedlings were dried at 80± 1ºC for 24 hours and dry weight was recorded. The mean seedling length and seedling dry weight were used for estimation of seedling vigour index-I (SVI-I) and Seedling vigour index-II (SVI-II) in two different methods using the following formula given by (Abdul Baki and Anderson, 1973).

SVI –I = Mean seedling length (cm) × Germination (%)

SVI-II = Mean seedling dry weight (mg) × Germination (%)

***Statistical analysis*:** For measurable characters the data generated is subjected to analysis of variance by adopting standard procedures given by Panse and Sukhatme (1969).

RESULTS AND DISCUSSION

Morphological observations on quantitative traits

The morphological characters pertaining to quantitative characters (as per DUS guidelines) were recorded for fifteen rice varieties are furnished in Table 1. For the character length of leaf blade, the varieties WGL 915 (58.10 cm) and KNM 1638 (45.60 cm) are recorded long leaf length and medium leaf length is recorded in rest of the thirteen rice varieties. The length of leaf blade ranged from 36.01cm in KNM 118 to 58.10 cm in WGL 915 (Table 1 & Fig 1a).

For the character width of the leaf blade all the rice varieties studied are categorized under the medium leaf width ranged from 1.22 cm in KNM 733 to 1.96 cm in WGL 915. The days to heading varied among the varieties under study. The varieties JGL 18047, KNM 1638, KNM 733, KNM 118, Tellahamsa, RNR 21278 are early with the duration ranging from 71 to 90 days. The varieties JGL 24423, WGL 739, WGL 962, WGL 44, RNR 29325, RNR 15048, RNR 15435 are medium with duration ranging from 92 to 105 days and the varieties RNR 11718, WGL 915 are observed as late with 110 days duration (Table 1). Singh *et al*. (2015) reported the variations in time of heading among the rice varieties and the present results are in conformity with them.

Medium stem thickness is observed in rice varieties JGL 18047 and KNM 1638 whereas; remaining thirteen rice varieties are categorized under thick stem. For the character stem length the variety WGL 915 has categorized under short whereas, remaining fourteen rice varieties are categorized under very short stem length (Table 1). With respect to the length of the main axis of the panicle the rice variety WGL 962 is categorized as short, RNR 15435 and WGL 915 as long and remaining twelve rice varieties are categorized under medium (Table 1). Except RNR 15435 (29.3cm) and WGL 915 (30cm) which are categorized as long the remaining thirteen rice varieties were categorized as medium because the length of panicle main axis does not cross above 25cm. The present study results are in line with the findings of Borah *et al*. (2016), where they reported that 75.66% rice varieties studied were having medium panicle length. Sharma *et al*. (2004) observed similar results in rice genotypes and discovered that only eight genotypes had panicle lengths greater than 25 cm while the rest genotypes had panicle lengths less than 25 cm and the present study is also in conformity with them.

The rice varieties WGL 739, RNR 15048 and RNR 11718 has few number of panicles per plant whereas, the remaining twelve rice varieties are categorized under medium number of panicles per plant (Table 1). Based on number of days taken for maturity the varieties JGL18047, KNM733, KNM 118, KNM1638 and Tellahamsa are grouped under early maturity. The days to maturity is ranged from 110 days to 120 days in this early group; the varieties JGL 24423, RNR 21278 and RNR15048 are fall under medium maturity group (125 to 138 days) and the varieties WGL739, WGL 44, WGL 915, WGL 962, RNR 29325, RNR11718, RNR15435 are categorized under late maturity group (138 to 148 days) (Table. 1) similar results are also reported by Ghosh *et al*. (2019); Borah *et al*. (2016). Bishnoi *et al*. (2021). The test weight of 1000 fully matured grains ranged from 14.41g in WGL 962 to 27.47g in JGL 24423.

Table 1: Quantitative morphological traits recorded for varietal identification among fifteen rice varieties.

Varieties	Leaf length (cm)	Leaf width (cm)	Time of heading (days)	stem thickness (cm)	Stem Length (cm)	Panicle length of main axis (cm)	Maturity (days)	Panicle number plant^{-1}	1000 Grain weight(g)	Grain Length (mm)	Grain Width (mm)	Endosperm content of amylose (%)	Decorticated grain length (mm)	Decorticated grain width (mm)
JGL-18047	37.34 Medium	1.25 Medium	76 Early	0.53 Medium	76.7 Very short	23.21 Medium	118 Early	16 Medium	27.20 High	9.56 Medium	1.94 Very narrow	22.6 Medium	6.44 Long	1.83 Narrow
JGL-24423	39.32 Medium	1.38 Medium	98 medium	0.68 Thick	77.32 Very short	23.08 Medium	125 Medium	17 Medium	27.47 High	9.55 Medium	2.47 Narrow	23.10 Medium	6.90 Long	2.1 Medium
KNM-1638	45.6 Long	1.59 Medium	87 Early	0.49 Medium	69.02 Very short	23.16 Medium	118 early	17 Medium	16.85 Low	7.86 Short	1.67 Very narrow	21.5 Medium	5.13 Short	1.57 Narrow
KNM-733	39.06 Medium	1.22 Medium	88 Early	0.70 Thick	74.48 Very short	25 Medium	120 Early	22 Many	16.76 Low	8.76 Medium	1.58 Very narrow	23.3 Medium	5.83 Medium	1.42 Narrow
KNM-118	36.01 Medium	1.34 Medium	85 Early	0.66 Thick	80.46 Very short	23.6 Medium	115 Early	19 Medium	16.62 Low	8.75 Medium	1.61 Very narrow	20.7 Medium	5.74 Medium	1.51 Narrow
WGL-739	42.86 Medium	1.41 Medium	92 Medium	0.61 Thick	66.58 Very short	22.8 Medium	146 late	9 Few	21.95 Medium	8.83 Medium	2.02 Very narrow	24.5 Medium	6.30 Long	1.91 Narrow
WGL-962	42.23 Medium	1.46 Medium	94 Medium	0.65 Thick	76.32 Very short	19.6 Short	140 late	11 Medium	14.41 Very low	7.46 Short	1.61 Very narrow	24.4 Medium	5.19 Short	1.52 Narrow
WGL-44	39.94 Medium	1.38 Medium	105 Medium	0.83 Thick	73.34 Very short	22 Medium	140 Late	12 Medium	15.44 Low	7.67 Short	1.84 Very narrow	23.6 Medium	5.18 Short	1.68 Narrow
WGL-915	58.10 Long	1.96 Medium	110 Late	0.71 Thick	94.06 Short	30 Long	145 Late	12 Medium	14.58 Very low	8.06 Short	1.57 Very narrow	23.8 Medium	5.44 Medium	1.31 Narrow
Tellahamsa	44.02 Medium	1.25 Medium	85 Early	0.60 Thick	77.86 Very short	23.5 Medium	110 early	14 Medium	23.50 Medium	9.36 Medium	1.96 Very narrow	22.4 Medium	6.65 Long	1.75 Narrow
RNR-29325	42.98 Medium	1.29 Medium	97 Medium	0.56 Thick	71.13 Very short	22.8 Medium	142 late	17 Medium	24.67 Medium	9.69 Medium	2.09 Very narrow	20.9 Medium	6.68 Long	1.65 Narrow
RNR-11718	44.13 Medium	1.44 Medium	110 Late	0.51 Medium	78.53 Very short	22.8 Medium	145 Late	10 Few	21.42 Medium	8.42 Short	2.30 Narrow	23.7 Medium	5.43 Medium	1.96 Narrow
RNR-21278	39.58 Medium	1.41 Medium	84 Early	0.60 Thick	73.5 Very short	21 Medium	138 Medium	19 Medium	14.80 Very low	7.76 Short	1.70 Very narrow	22.5 Medium	5.12 Short	1.49 Narrow
RNR-15048	37.52 Medium	1.3 Medium	95 medium	0.55 Medium	88.23 Very short	24.8 Medium	125 Medium	7 Few	14.70 Very low	8.14 Short	1.56 Very narrow	20.8 Medium	5.48 Medium	1.38 Narrow
RNR-15435	58.16 Long	1.1 Medium	100 Medium	0.64 Thick	88.6 Very short	29.3 Long	148 Late	13 Medium	23.61 Medium	11.64 Long	1.57 Very narrow	23.9 Medium	8.4 Very long	1.34 Narrow

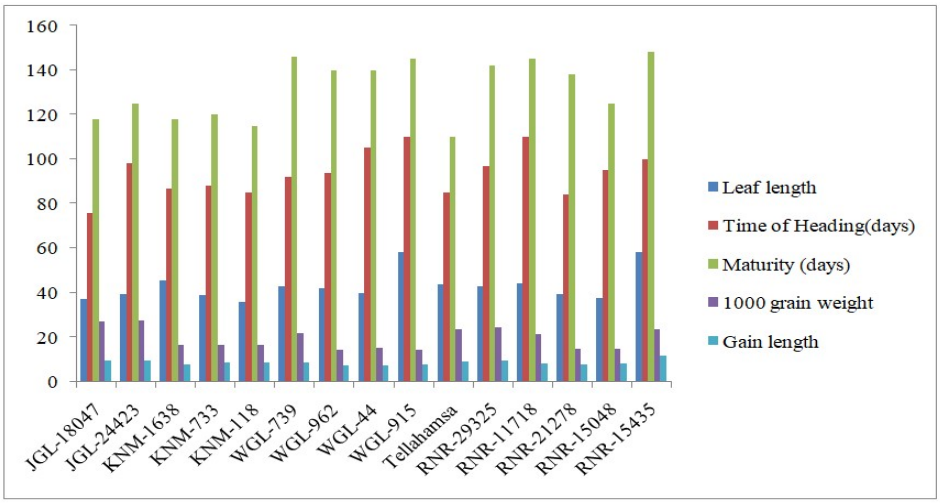

Fig. 1a. Quantitative morphological trait variation among fifteen rice varieties under study.

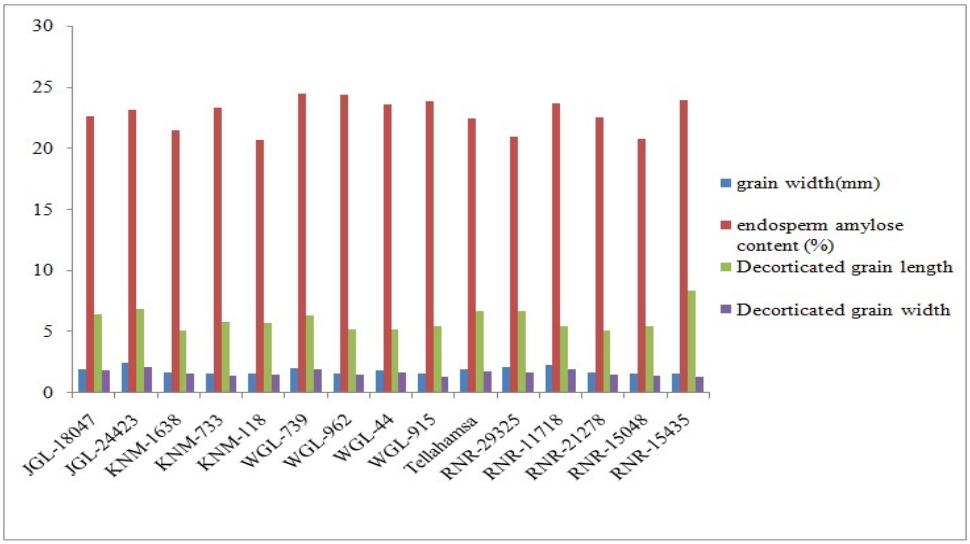

Fig. 1b. Quantitative morphological trait variation among fifteen rice varieties under study.

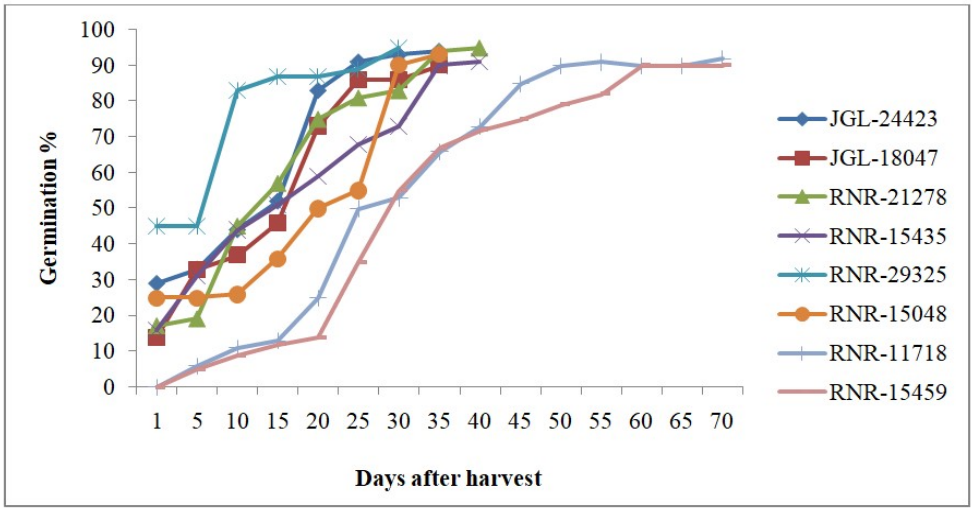

Fig. 2. Dormancy period in rice varieties.

The varieties WGL 962, WGL 915, RNR 21278 are categorized under very low test weight group (14.41 g to 14.80 g); the varieties KNM 1638, KNM 733, KNM 118, WGL 44 are classified under low test weight group (15.44 g to 16.85 g); the varieties WGL 739, Tellahamsa, RNR 29325, RNR11718, RNR15435 are categorized under medium test weight group (21.42g to 21.95g) and the highest test weight is recorded in JGL 18047& JGL 24423 (Table 1).The grain length ranged from 7.46 mm in WGL 962 to 11.64 mm in RNR 15435. The varieties KNM 1638, WGL 44, WGL 962, WGL 915, RNR 11718, RNR 21278 and RNR 15048 are recorded short grain length and the grain length ranged from 7.67 mm to 8.42 mm. The variety RNR-15435 is recorded long grain length. The varieties JGL 18047, JGL 24423, KNM 733, KNM 118, WGL739, Tellahamsa recorded medium grain length (8.75 to 9.69 mm) (Table 1 & Fig.1a). The grain width of fifteen rice varieties is studied and it ranged from 1.56 mm in RNR-15048 to 2.47 mm in JGL-24423. The grain width was very narrow in the rice varieties JGL 18047, KNM 1638, KNM 733, KNM 118, WGL 739, WGL 44, WGL 962, WGL 915 RNR 15435, Tellahamsa, RNR 29325, RNR 21278 and RNR 15048 (1.56 to 2.00 mm) and in the varieties JGL 24423, RNR 11718 narrow grain width is recorded (Table 1&2).

Decorticated grain length for all the fifteen rice varieties studied is ranged from 5.12 mm in RNR 21278 to 8.4 mm in RNR-15435. The rice varieties RNR 21278, WGL 44, WGL 962, KNM 1638 are classified as short (5.12 to 5.18mm); the varieties KNM 733, KNM 118, WGL 915, RNR 11718, RNR-15048 are classified under medium (5.43 to 5.83mm); the varieties JGL 18047, JGL24423, WGL 739, Tellahamsa, RNR 29325 are categorized under long (6.30 to 6.90 mm) and RNR-15435 is categorized under very long. Decorticated grain width of all the varieties is categorized under narrow and the grain width ranged from 1.31 mm in WGL 915 to 1.96 mm in RNR 11718 (Table 1 & 2). Physical measurements of length, width, as well as 1000 grain weight are used in the laboratory to quantify these features. Earlier reports by Sinha and Mishra (2012); Tirkey *et al*. (2013); Semwal *et al*. (2014) revealed that 1000 grain weight was used to characterize rice varieties. Bai *et al*. (2010); Mao *et al*. (2010) reported that the seed size is also an essential agronomic feature to consider when assessing the yield potential and to distinguish rice varieties. Amylose content in the endosperm is estimated for fifteen rice varieties and all the varieties were fall under medium category ranging from 20.7% to 24.5%. The variety WGL 739 has recorded highest amylose content (24.5%) whereas, the variety KNM 118 has recorded the lowest amylose content (20.7%) (Table 1 & Fig. 1b). Rice with high amylose content (25-30%) tends to cook firm and dry, whereas rice with intermediate amylose content (20-25%) is generally soft and sticky whereas with low amylose content (<20%) cooks soft and sticky. Kapoor *et al*. (2019) studied endosperm amylose content in fifty rice cultivars out of which thirty six cultivars were having medium amylose content, thirteen having low and one cultivar has high amylose content. Verma *et al*. (2015) observed variation for endosperm amylose content from 2.0 to 24.5% in rice cultivars which were grouped under low to medium category. These results suggested that the plant morphological traits exhibited dissimilarities among the rice varieties studied and these morphological characters can be used for distinguishing the varieties from each other.

The mean, range, standard deviation and coefficient of variation for the fourteen quantitative characters among 15 rice varieties are given in Table 2. The mean data recorded on various quantitative morphological characters *viz*., length of leaf blade (cm), width of leaf blade (cm), stem thickness (cm), stem length (cm), panicle length of main axis (cm), panicle number per plant, time of heading (days), maturity (days), 1000 grain weight (g), grain length (mm), grain width (mm), decorticated grain length (mm), decorticated grain width (mm), amylose content of endosperm (%). These characters are subjected to statistical analysis of variance which indicated that there is significant difference among all the characters at the 0.001 probability levels except for the character stem length which recorded significant difference at 0.01 probability level. The mean sum of squares for all the above mentioned characters is presented in Table 3.

Studies on estimation of dormancy period. The results of dormancy breaking studies conducted in sixteen varieties were presented in Table 2. Among the varieties studied from Rajendranagar station, the variety Tellahamsa exhibited 90% germination immediately after harvest whereas, RNR-11718 has taken the longest duration to break dormancy i.e., 45 days after harvest to exhibit 90% germination. Immediately after harvest the varieties RNR-21278, RNR-15435 and RNR-15048 showed very low germination %, *i.e*., 20%, 16%, 29% respectively. And both RNR-21278 and RNR-15435 were taken 35 days to break dormancy after harvest. Whereas, the varieties RNR-15048 and RNR-29325 have taken 31days and 27 days respectively to break dormancy after harvest (Table 4). The two varieties from Jagtial station took approximately one month to completely break their dormancy. The variety JGL-24423 has registered a higher germination percentage at 27 days after harvest followed by the variety JGL-18047 which has taken 34 days for breaking its dormancy (Table 4 and Fig 2). The cultivars from Kunaram station, KNM-1638 and KNM-118 exhibited a relatively lower dormancy period compared to KNM-733. KNM-1638 has taken only 19 days to break its dormancy completely. Whereas KNM-118 has taken 27 days and KNM-733 has taken 38 days to completely break its dormancy (Table 4). Among the varieties obtained from Warangal station varieties, WGL-44 and WGL-962 showed lower dormancy periods i.e., 26 days and 28 days respectively, compared to other varieties of the station.

Table 2: Mean, range, standard deviation and coefficient of variation for the quantitative morphological characters among fifteen rice varieties.

S. No.	Character	Mean	Range	S.D	C.V
1.	leaf length (cm)	43.19	36.01-58.16	3.30	7.66
2.	leaf width (cm)	1.38	1.1-1.96	0.14	10.18
3.	stem thickness(cm)	0.62	0.49 - 0.83	0.06	9.50
4.	stem length(cm)	77.74	66.58 - 94.06	7.03	9.04
5.	Panicle length of main axis (cm)	23.79	19.6 - 30.00	0.96	4.07
6.	Panicle number plant^{-1}	14.77	9 - 22	2.88	23.30
7.	1000 grain weight(g)	19.60	14.41 - 27.47	0.36	1.82
8.	Grain length (mm)	8.76	7.46 – 9.69	0.29	3.32
9.	Grain width(mm)	1.83	1.57 – 2.47	0.12	6.93
10.	Endosperm content of amylose (%)	22.78	20.7-24.5	0.43	1.88
11.	Decorticated grain length(mm)	5.99	5.12 - 8.40	0.07	1.21
12.	Decorticated grain width (mm)	1.62	1.31 – 2.10	0.05	2.97
13.	Time of heading (days)	94	76-110	4.01	4.27
14.	Maturity (days)	132	110-146	4.53	3.433

Table 3: Analysis of variance for quantitative DUS descriptors of fifteen rice varieties.

Source of variation	df	Leaf: length of blade(cm)	leaf: width of blade (cm)	Stem length (Excluding panicle	Panicle : length of main axis (cm)	Panicle number per plant	Time of heading	Stem: Thickness	Maturity (days)	1000 grain Weight (g)	Grain Length (mm)	grain width (mm)	Decorticated grain length (mm)	Decorticated grain width (mm)	Amylose content of endosperm (%)
Replications	2	40.715	0.003	187.056	4.077	70.956	100.155	0.014	12.067	0.499	0.124	0.021	0.005	0.001	0.302
varieties	14	134.496***	0.117**	170.991**	22.54***	54.984***	297.270***	0.024**	516.299***	69.979***	3.527***	0.251***	2.485***	0.172***	5.018**
Error	28	10.959	0.02	49.445	0.942	11.86	16.084	0.004	20.495	0.128	0.085	0.016	0.005	0.002	0.183
SE(Mean)		1.911	0.081	4.059	0.56	1.988	2.315	0.034	2.614	0.206	0.168	0.073	0.042	0.028	0.247
C.D		5.537	0.237	11.761	1.623	5.76	6.742	0.099	7.61	0.599	0.487	0.487	0.121	0.081	0.719

Note: *, **, *** represent significance at 0.05, 0.01, 0.001 probability levels.

Table 4: Estimation of dormancy period in fifteen rice varieties using germination test.

Days after harvest	JGL2423	JGL18047	RNR21278	RNR15435	RNR29325	RNR15048	RNR11718	KNM118	KNM1638	KNM733	WGL44	WGL915	WGL739	WGL962	TELLAHAMSA
1	29	14	17	16	45	25	0	22	41	31	51	12	5	0	90
4	33	23	19	31	49	25	6	29	65	37	76	30	8	27	90
7	34	25	24	35	67	35	11	33	63	42	81	27	2	41	91
10	44	37	45	44	83	26	13	43	70	46	82	47	9	51	90
13	52	40	49	50	87	36	25	46	79	49	81	60	60	71	93
16	70	46	52	51	87	50	50	69	81	60	85	62	62	80	92
19	75	62	57	54	89	51	53	70	92	66	85	62	62	83	93
22	83	73	75	59	87	50	66	80	92	66	87	66	68	85	95
25	85	86	81	68	89	65	70	85	94	72	91	75	75	88	
28	**93**	86	83	73	**96**	85	73	93		78	91	80	84	91	
31		88	85	83	95	**93**	76	93		80		90	85		
34		**91**	**94**	**90**			85	94		84			90		
37		94		91			83			90			91		
40							86								
43							88								
46							90								

The variety WGL-739 has taken 33 days to break its dormancy after harvest followed by WGL-915 which has taken 30 days after harvest (Table 4). The dormancy periods among the varieties obtained from different research stations differ significantly and the results were in accordance with (Shanmugasundaram, 1953; Ghose *et al*., 1956). Except for the variety, Tellahamsa rest of the varieties studied were showing the dormancy period varies from 19 days to 45 days which indicates these varieties will not have any problem regarding *in situ* germination. And the physical or mechanical means of dormancy breaking methods need to apply if one wishes to go for immediate sowings for the next season.

Germination % and Seedling vigour. After studying the dormancy period among the varieties the germination % and seedling vigour were studied. The germination % was recorded highest in the variety

WGL-962 (96.0%) followed by RNR-15048 (95.0%) which were taken 28 and 31 days for breaking their dormancy respectively. The lowest germination percentage was recorded in the variety RNR-15435 (85%) which has taken 35 days for breaking the dormancy (Table 5 & Fig. 2). The fifteen entries were studied for their seedling vigour both for vigour index-I and II. The variety RNR-29325 has recorded the highest seedling vigour index-I (2516) followed by the variety JGL-24423 (2411) which were showed the germination % of 93% and 89% respectively. Chaturvedi *et al*. (2012) reported Speed of germination provides good reflection of seed vigor, similar results were obtained in the present study. The variety KNM 118 has recorded the lowest seedling vigour index-I (1834) with 90% germination (Table. 5 & Fig. 2). In case of seedling vigour index-II the variety JGL-24423 recorded maximum seedling vigour index-II (9312) followed by Tellahamsa (8619) and JGL-18047 (8363). Among the varieties studied the variety JGL-24423 has recorded good seedling vigour index-I and II which indicating the good initial plant establishment and good storability characters for this variety (Table 5 & Fig. 2).

Table 5: Estimation of fresh seed germination %, Seedling vigour Index-I and Seedling vigour Index-II for fifteen rice varieties.

Ta Germination %, seedling vigour index-I and seedling vigour index-II in rice varieties				
S. No.	Varieties	Germination %	SVI-I	SVI-II
1.	JGL-18047	89	2269	8363
2.	JGL-24423	89	2411	9312
3.	KNM-118	90	1843	5420
4.	KNM-733	89	1918	5383
5.	KNM-1638	93	2349	5426
6.	WGL-915	93	1975	4381
7.	WGL-962	96	2161	5763
8.	WGL-739	91	2288	7505
9.	WGL-44	93	2370	5399
10.	RNR-15048	95	2314	4832
11.	RNR-11718	91	2043	7416
12.	RNR-15435	85	1984	6229
13.	TELLAHAMSA	88	2141	8619
14.	RNR-21278	93	2109	4538
15.	RNR-29325	93	2516	8047
CD		4.59	126.15	431.47
SEM		1.61	44.27	151.27
CV		3.54	4.12	4.87

CONCLUSION

From the present study we can conclude that, among the varieties studied for fourteen quantitative morphological characters variation is found among the fifteen rice varieties for 13 quantitative characters .No variations were observed for Endosperm amylose content and leaf width. No dormancy was recorded in the variety Tellahamsa and in the remaining varieties varies it ranged from from 19 days to 45days. The highest fresh seed germination % was recorded in the variety WGL-962 (96.0%) and lowest in RNR-15435 (85.3%). The variety RNR-29325 has recorded the highest fresh seedling vigor index-I (2516) and the variety KNM 118 has recorded the lowest seedling vigour index-I (1834). The variety JGL-24423 recorded maximum fresh seedling vigour index-II (9312). Among the varieties studied the variety JGL- 24423 has recorded good seedling vigour index-I and II which indicating the good initial plant establishment and good seed longevity for this variety.

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Conflict of Interest. None.

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