International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2021; SP-9(1): 174-177

Received: 15-11-2020
Accepted: 19-12-2021

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Genotypic evaluation of different rice varieties for yield and yield related traits of Eastern Uttar Pradesh

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DOI: https://doi.org/10.22271/chemi.2021.v9.i1d.11561

Abstract
Investigation were undertaken at Zonal Agricultural Research Sub Station, (ANDUAT) Ghazipur, during 2018 and 2019 to study the performance of various rice genotypes for yield and yield characters under the agro-ecological conditions of Gazipur to investigated among 10 rice varieties including check. The experiment was laid out in Randomized Complete Block Design (RCBD) with having three replications. This evaluation is vital to know the effects of various characters on yield for selection criteria for high yielding genotype. Yield and yield related traits were studied. Statistical analysis exhibited that rice varieties differed significantly for days to 50% flowering (DFF), plant height cm (PH), panicle length cm (PL), panicle per sqm, (EBT), days to maturity (DM), grain yield q/ha (GY),total grain/panicle. Sterility % and thousand grain weight (TGW). Moreover, significantly positive genotypic correlations of grain yield with PH, PL, EBT and TGW were observed. Principal component analysis also classified superior varieties, shows that maximum yield was recorded for NDR- 370135 (58.20 q/ha), followed by NDR-370133 (57.30q/ha), NDR – 370134 (56.68 q/ha) and NDR- 2105 (52.85 q/ha).These varieties can be used as commercial cultivars in Gazipur area after multi- location yield test trials.

Keywords: rice, varieties, evaluation, yield, phenotype and yield characters

Introduction

Rice (*Oryza sativa* L.) is one of the cereals of major significance in the world and the main food resource, after wheat, for more than half of the world population (Ruiz *et al*., 2005; Acevedo *et al*., 2006; Álvarez *et al*., 2008; Canfalonieri *et al*., 2011) [13, 1, 2, 5], mainly in developing countries. World per capita consumption is placed around the 56.9 kg (FAO, 2013) [7]. Improving rice (*Oryza sativa* L.) production per unit area will be a major threat in future due to the increasing global population and rice demand in the world. Rice is the main food of majority of the world's population. It provides at least 27% of the nutritional diet and 20% of the protein consumption in the developing world. Climatic variation is one of the fundamental causes for yield variability of several crops, in particular on rice (Akinbile, 2013) [7]. The former statement leads to the need for the study of the interaction of meteorological variables with rice cultivar behavior to establish the basis for crop management and yield increment. Current agriculture tends to increase the importance of genotype behavior in local environments to increase productivity. In this sense, it is fundamental knowledge of processes and mechanisms that determine growth and consequently, biological and agricultural yield, as well as how they are affected by the meteorological conditions. An important element in rice yield formation is grain filling, where fertilized ovaries develop into caryopsis (Takai *et al*., 2005) [16]. Its duration and filling rate are essential elements contributing to final yield. Authors that studied the grain filling process in cereals, stated that the relation among sink-source organs is crucial for the event, where grain filling (sink) could be limited by leaf photosynthetic activity (source), the grain carbohydrate deposition (sink) or both and where climate is important in cultivar response (Yang and Zhang, 2010; Hernández and Soto, 2012; 2013) [17, 10]. Yield potential is defined as the yield of a cultivar when grown in an environment to which is adapted, with nutrients and water non-limiting and with biotic stresses effectively controlled (Evans and Fischer, 1999) [6]. Hence, Yp is determined by solar radiation, temperature, carbon dioxide concentration, and crop physiological attributes governing light interception, conversion into biomass, and partition into harvestable organs. Yield gaps could be analyzed through well-calibrated crop simulation models coupled with high-quality weather, soil and crop management data (Merlos *et al*., 2015) [12]. Rice production systems can be simply classified into lowland and upland rice. In lowland rice, fields are usually flooded during part or all of the growing season; lowland rice includes rain-fed lowland, irrigated lowland, deep-water and mangrove swamp. Upland rice is generally grown on level or sloping, unbunded fields. Flooding is rare in this system. In some cases, especially in Latin America, supplemental irrigation may be used. Upland rice is grown under crop rotation systems with other crops, or under slash-and-burn systems (Atlin *et al*., 2006 Pinheiro *et al*., 2006) [3, 4]. Recent statistics from 71 countries from Asia, Latin America and sub-Saharan Africa show that lowland and upland rice account for 92 and 8% of total rice cultivation area, respectively. Rice has been feeding the Southeast Asian population for well over 4000 years and has been the staple food of about 557 million people (Manzanilla *et al*., 2011) [11]. The main objectives of the present study were, to evaluate rice varieties for yield and yield related traits and study the phenotypic and genotypic correlations among various yield related traits.

Material and Methods

Experiment were conducted during WS 2018 and 2019 at Zonal Agricultural Research Sub Station, (ANDUAT) Ghazipur. The soil is sandy loam low in organic carbon. It is rich in potassium, medium in phosphorus and possesses good water holding capacity. The experimental material consisted of twenty genotypes including check of Rice (*Oryza sativa* L.). The nursery was sown 2nd week of June every year. After 25 days, seedlings transplanted in the main field in Randomized Complete Block Design (RCBD) in three replications with a spacing of 20 x 15 cm. Recommended dose of fertilizer 120:60:60:25 kg N: P: K: and ZnSo4/ha Half of the dose of N and full dose of P: K and ZnSo4 were applied basal, while remaining N were top-dressed in 2 equal splits–at tillering and panicle initiation stage. To control weeds, Rift @ 1.25 litre/ha was applied just after transplanting. Crop was harvested at physiological maturity and grain yield was calculated at 14% grain moisture. Single plant observations were recorded on five plants selected at random per genotype per replication for characters viz., days to 50% flowering (DFF), plant height cm (PH), panicle length cm (PL), panicle per sqm, (EBT), days to maturity (DM), grain yield q/ha (GY),total grain/panicle. Sterility % and thousand grain weight (TGW). The data on grain yield of each plot were recorded separately by threshing the harvested rice genotypes. The data so obtain were subjected to statistical analysis after necessary transformation for final statistical analysis (Gomez and Gomez, 1983) [8]. Two season data on grain yield separately recorded the mean value.

Results and Discussion

For days to 50% flowering, significantly among the rice varieties were observed (Table 1 & figure 2). DFF among the varieties ranged from 80 to 106 days. Minimum days to 50% flowering (80) was noted for NDR- 3112-1 while maximum days to 50% flowering (106) was recorded for NDR 359. Moreover, it is also confirmed by phenotypic and genotypic correlations of DFF. For days to maturity, significantly among the rice varieties were observed (Table 1). DM among the varieties ranged from 110 to 136 days. Minimum days to maturity (110) were noted for NDR-3112-1 while maximum days to maturity (136) were recorded for NDR 359 Moreover, it is also confirmed by phenotypic and genotypic correlations of DFF with DM which showed significantly correlation. For plant height cm, significantly among the rice varieties were observed. PH among the varieties ranged from 111 to 137 cm. Minimum plant height cm (111) was noted for NDR 2101 while maximum plant height (137) was recorded for NDR 359. The panicle length cm, significantly among the rice varieties was observed. Panicle length cm ranged from among the varieties 26.0 to 30.2 cm. Minimum panicle length cm (26.0) was noted for NDR-3112-1 while maximum panicle length (30.2) was recorded for NDR-370135. The panicle per sqm EBT, significantly among the rice varieties was observed. Panicle per sqm ranged from among the varieties 257 to 346. Minimum panicle per sqm (257) was noted for NDR- 2101 while maximum EBT (346) was recorded for NDR-370135 presented in figure 3. Significant grain yield was observed among the rice varieties (Table 1). Mean data revealed that the difference in GY among the varieties ranged from 48.89 to 58.20 q/ha. NDR-370135 (58.20 q/ha), followed by NDR-370133 (57.30q/ha), NDR –370134 (56.68 q/ha) and NDR-2105 (52.85 q/ha). in figure 1. GY showed significant positive genotypic correlation with EBT and PL. Superior varieties on the bases of yield traits were also depicted through principle component analysis. Total grain /panicle range from 149 (NDR- 2105) to NDR-370135 (239). Sterility % ranged from 7.8 NDR-370135 to NDR –2101 (21.4). Test weight (g) ranged from NDR- 3112-1 (23.3) to NDR 359 (27.0) in figure 4.

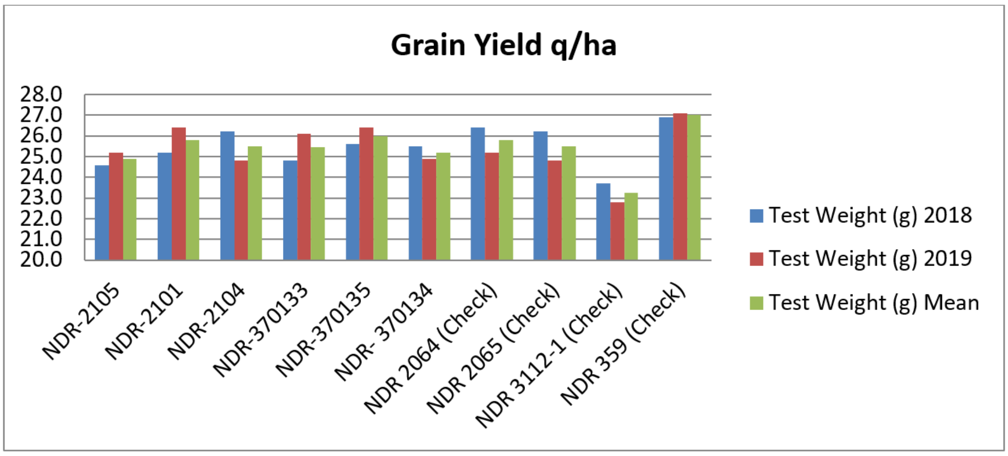

Fig 1: Grain yield q/ha.

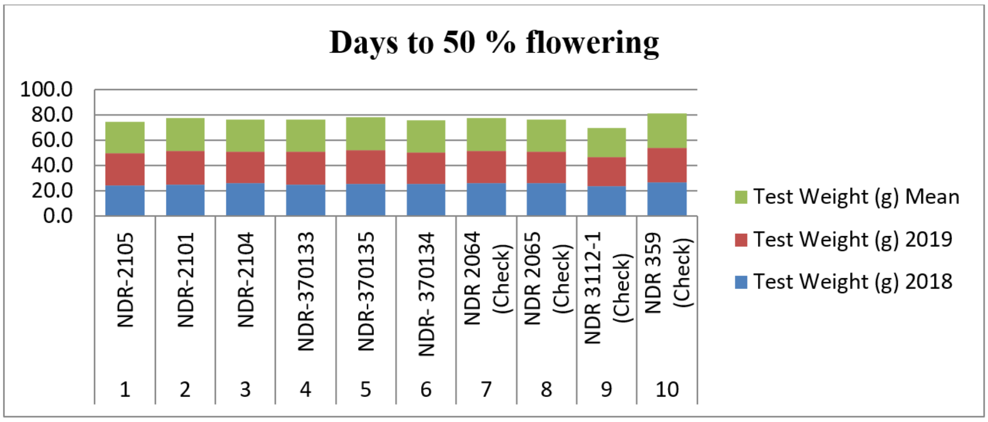

Fig 2: Days to 50% flowering

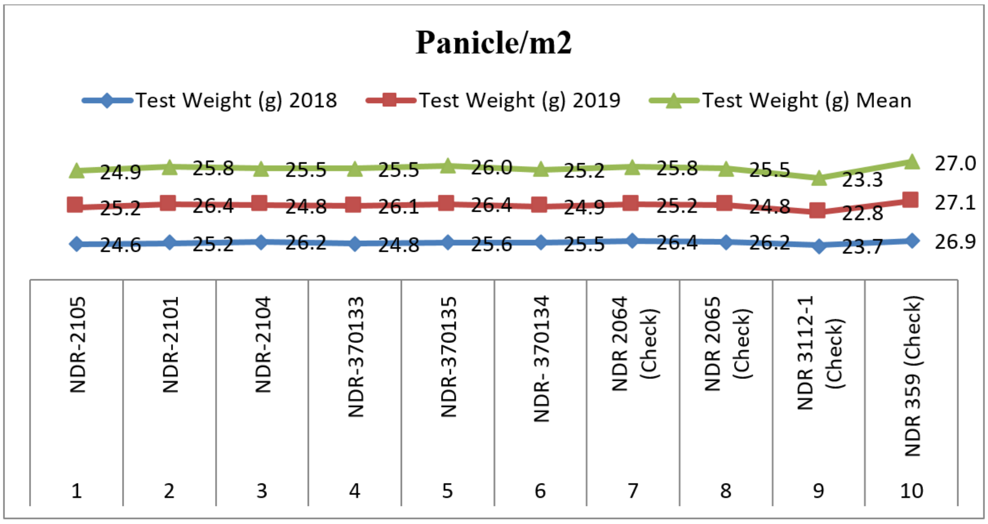

Fig 3: EBT/m2

Table 1: Relationship between growth traits and yield formation.

Strains/Varieties	Days to 50 % flowering			Days to days to maturity			Plant height cm			Panicle length			Panicle/m2			Grain yield q/ha		
	2018	2019	Mean	2018	2019	Mean	2018	2019	Mean	2018	2019	Mean	2018	2019	Mean	2018	2019	Mean
NDR-2105	93	91	92	122	121	122	122	120	121	26.9	27.4	27.2	302	307	305	53.40	52.30	52.85
NDR-2101	92	91	92	121	121	121	112	110	111	25.7	26.4	26.1	251	263	257	45.50	49.10	47.30
NDR-2104	94	92	93	123	122	123	120	117	119	26.9	27.2	27.1	289	292	291	52.10	51.33	51.72
NDR-370133	97	95	96	126	125	126	116	114	115	28.7	27.9	28.3	313	309	311	58.10	56.50	57.30
NDR-370135	95	93	94	124	123	124	113	112	113	30.6	29.8	30.2	341	350	346	59.40	57.00	58.20
NDR- 370134	100	96	98	129	126	128	113	112	113	29.8	30.2	30.0	319	309	314	57.60	55.75	56.68
NDR 2064 (Check)	92	94	93	121	124	123	135	138	137	26.9	27.1	27.0	292	278	285	53.10	52.11	52.61
NDR 2065 (Check)	91	93	92	120	123	122	132	137	135	27.1	26.1	26.6	287	276	282	52.60	51.50	52.05
NDR 3112-1 (Check)	81	79	80	110	109	110	121	125	123	25.2	26.8	26.0	263	259	261	48.90	47.50	48.20
NDR 364 (Check)	105	107	106	134	137	136	128	122	125	26.9	27.1	27.0	252	248	250	46.90	45.60	46.25

Table 2: Relationship between total grain/panicle, sterility% and test weight (g).

S.No.	Strains/Varieties	Total grain/panicle			Sterility %			Test Weight (g)		
		2018	2019	Mean	2018	2019	Mean	2018	2019	Mean
15	NDR-2105	148	149	149	20.2	19.8	20.0	24.6	25.2	24.9
16	NDR-2101	152	154	153	20.8	21.9	21.4	25.2	26.4	25.8
17	NDR-2104	142	141	142	20.6	19.8	20.2	26.2	24.8	25.5
18	NDR-370133	220	215	218	7.4	8.2	7.8	24.8	26.1	25.5
19	NDR-370135	236	242	239	6.6	4.6	5.6	25.6	26.4	26.0
20	NDR- 370134	201	207	204	10.6	10.8	10.7	25.5	24.9	25.2
7	NDR 2064 (Check)	207	195	201	12.8	14.2	13.5	26.4	25.2	25.8
8	NDR 2065 (Check)	198	186	192	15.6	16.4	16.0	26.2	24.8	25.5
9	NDR 3112-1 (Check)	168	160	164	14.9	15.2	15.1	23.7	22.8	23.3
10	NDR 364 (Check)	148	152	150	16.1	17.2	16.7	26.9	27.1	27.0

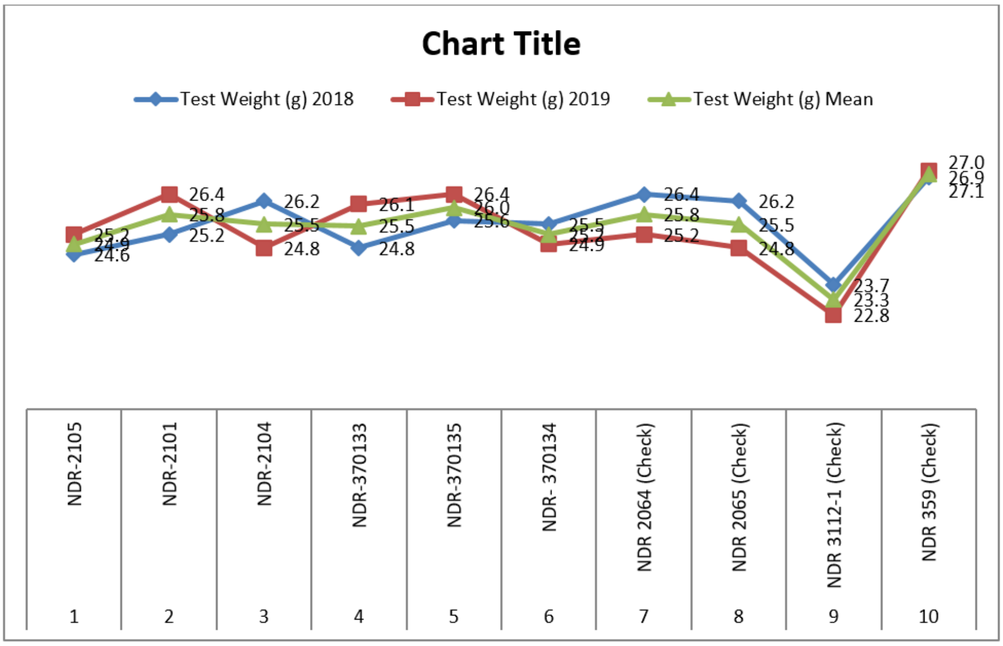

Fig 2: Test weight (g)

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