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COMPARATIVE STUDY OF TWO RICE CULTIVARS (*Oryza glaberrima* and *O. sativa*) UNDER DIFFERENT CULTURAL CONDITIONS

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KEYWORDS

O. glaberrima

O. sativa

Core collection

Toposequence

Variability

ABSTRACT

This study was conducted to evaluate and compare the growth performance of two rice species viz *Oryza glaberrima* and *O. sativa* under different hydrological conditions. For this, 21 accessions of *O. glaberrima* and 69 of *O. sativa* core collection were cultivated in different water regimes ranging from drought-prone upland to lowland using a toposequence (rainfed upland, rainfed hydromorphic and irrigated lowland) at the experimental field of Africa Rice, Ouedeme, Bénin, during 2010 and 2011 wet seasons. Results of study revealed higher Morpho-physiological and phenological variability among the core collections of *O. sativa* and *O. glaberrima* genotypes. Further, among various studied attributes, *O. glaberrima* showed higher number of tillers at maturity as compared to *O. sativa* in the second season. Moreover, *O. glaberrima* also showed long crop duration as compared to *O. sativa*. Leaf area and specific leaf area discriminated *O. sativa* from *O. glaberrima* in all ecologies. Further, *O. glaberrima* also indicated higher leaf area on every sampling date. In case of plant height, non-significant difference was not reported for both species. Variation in results between the two seasons could be justified by the difference between average rainfalls.

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1 Introduction

Rice (*Oryza sp.*) is a major staple food crop in West Africa. Recently, It became a strategic commodity in Africa but its availability and prices are the two major determinants for the welfare of poor consumers threatened by food insecurity (Nwanze et al., 2006; Saito et al., 2010). It grows and widely consumed by more than 40 African countries where about 20 million farmers are engaged in its production and about 100 million peoples directly or indirectly depend on the rice production (Nwanze et al., 2006). Genus *Oryza* comprises 22 species but among these only two i.e. *O. sativa* or Asian Rice and *O. glaberrima* or African Rice were cultivated throughout the world. Among this, *O. sativa* was domesticated more than 10,000 years ago (Kovach et al., 2007) and now it is widely cultivated in various ecologies of the world.

According to Harlan & Stemler (1976) this variety introduced in Africa about 2,000 years ago. This specie contains different subspecies, among these *O. sativa var japonicais* is well adopted for upland ecosystem while *O. sativa var indica* performing well under various other ecosystems (Kato, 1930). Compared to *O. sativa*, *O. glaberrima* has short domestication history and according to Linares (2002) this species introduced about 2000-3000 years backs. It can be classified in two ecological groups viz upland and lowland ecosystems (Oka, 1974). Like *O. sativa*, *O. glaberrima* does not have any sub-groups (Morishima et al.,1962). To argue this statement, Futakuchi & Sie (2009) concluded that some upland cultivar of *O. glaberrima* has resistances to lowland constraints. Further, several studies have clarified that these difference between *O. sativa* and *O. glaberrima* may based on various morphological characters (Morishima et al., 1962) such as short ligule, glabrous leaves in *O. glaberrima* and long ligule in the *O. sativa*. Knowledge of comparison between *O. sativa* and *O. glaberrima* is limited with morpho-physiological and phenological traits. The present study aims to compare *O. glaberrima* and *O. sativa* through different hydrological conditions.

2 Materials and Methods

Sixty nine (69) varieties of *O. sativa* germplasm was used in this study, these were the core collection of Kojima et al. (2005) and developed at National Institute of Agrobiological sciences, Japan while the twenty-one (21) accessions of *O. glaberrima* were collected from Africa Rice gene bank. Table 1 listed the various accessions which were used in present study. Seed of all genotypes were sown in artificially developed three ecosystems (upland, no flooded hydromorphic and irrigated lowland) at the experimental field of Africa Rice, Ouedeme (6°42'46"N, 1°41'07"E). The experimental design was Alpha Lattice with three replications of each ecosystem. Nine incomplete blocks were considered in each replicate and ten genotypes in each block. The size of plot was 2 m² and the space between plants to plants was 25 cm. The experimental plots were fertilized by recommended dose of NPK (15-15-15) which was applied @ 200 kg/ha at 25 days after sowing (DAS) and 50 kg/ha urea was applied at 40 DAS.

All the necessary agronomic practices recommended for rice have been carried out timely as per standard procedure. In the upland and hydromorphic ecosystems, dry seeds were sown while in lowland cultivation, pre-germinated seeds were sown in a nearby seedbed nursery and transplanted into the main plots at 18 DAS. The vegetative vigor data were recorded in all ecosystems at 30 DAS while plant height and tiller number were recorded at the maturity. Days to maturity was visually assessed on a daily basis starting from booting stage. Data collections have been done according to SES developed by IRRI (1996). Leaf area (LA) was measured by using leaf area meter (LI-3000, LI-COR) at 31DAS, 46DAS and 56DAS. Specific leaf area (SLA) at each sampling date was calculated dividing LA by leaf dry weight. Statistical data analysis was performed using GENSTAT (2003) to compare *O. sativa* and *O. glaberrima* for all variables involved in this study.

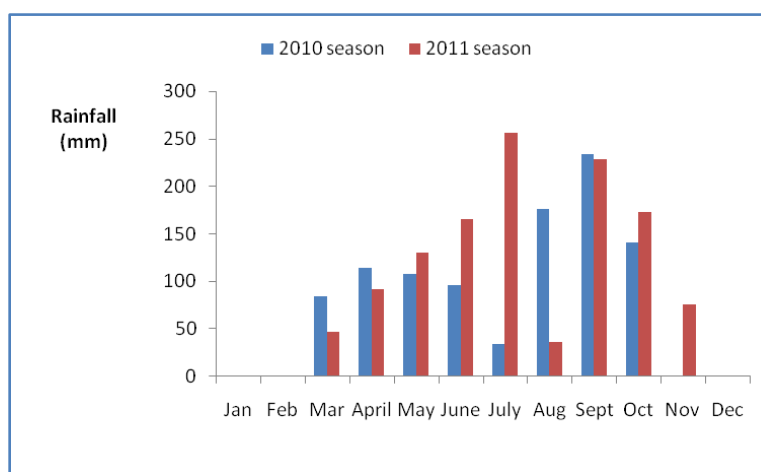


Figure 1 Rainfall distribution in 2010 and 2011.

Table 1 List of the *O. sativa* and *O. glaberrima* cultivars used in present study

S. No.	GENOTYPES	WRC N°	ORIGINS	S. No.	GENOTYPES	WRC N°	ORIGINS
<i>O. sativa</i> (core collection)							
1.	NIPPONBARE	WRC 01	JAPAN	36.	SURJAMUKHI	WRC 33	INDIA
2.	KASALATH	WRC 02	INDIA	37.	ARC 7291	WRC 34	INDIA
3.	BEI KHE	WRC 03	CAMBODIA	38.	ARC 5955	WRC 35	INDIA
4.	JENA 035	WRC 04	NEPAL	39.	RATUL	WRC 36	INDIA
5.	NABA	WRC 05	INDIA	40.	ARC 7047	WRC 37	INDIA
6.	PULUIK ARANG	WRC 06	INDONESIA	41.	ARC 11094	WRC 38	INDIA
7.	DAVAO 1	WRC 07	PHILIPPINES	42.	BADARI DHAN	WRC 39	NEPAL
8.	RYOU SUISAN KOU MAI	WRC 09	CHINA	43.	NEPAL 555	WRC 40	INDIA
9.	SHUUSOUSHU	WRC 10	CHINA	44.	KALUHEENATI	WRC 41	SRILANKA
10.	JINGUOYIN	WRC 11	CHINA	45.	LOCAL BASMATI	WRC 42	INDIA
11.	DAHONGGU	WRC 12	CHINA	46.	DIANYU 1	WRC 43	CHINA
12.	ASU	WRC 13	BHUTAN	47.	BASILANON	WRC 44	PHILIPPINES
13.	IR 58	WRC 14	PHILIPPINES	48.	MA SHO	WRC 45	MYANMAR(BURMA)
14.	CO 13	WRC 15	INDIA	49.	KHAO NOK	WRC 46	LAOS
15.	VARY FUTSI	WRC 16	MADAGASCAR	50.	JAGUARY	WRC 47	BRAZIL
16.	KEIBOBA	WRC 17	CHINA	51.	KHAU MAC KHO	WRC 48	VIETNAM
17.	QINGYU(SEIYU)	WRC 18	TAIWAN	52.	PADI PERAK	WRC 49	INDONESIA
18.	DENG PAO ZHAI	WRC 19	CHINA	53.	REXMONT	WRC 50	USA
19.	TADUKAN	WRC 20	PHILIPPINES	54.	URASAN 1	WRC 51	JAPAN
20.	SHWE NANG GYI	WRC 21	MYANMAR(BURMA)	55.	KHAU TAN CHIEM	WRC 52	VIETNAM
21.	CALOTOC	WRC 22	PHILIPPINES	56.	TIMA	WRC 53	BHUTAN
22.	LEBED	WRC 23	PHILIPPINES	57.	TUPA 729	WRC 55	BANGLADESH
23.	PINULUPOT 1	WRC 24	PHILIPPINES	58.	MILYANG 23	WRC 57	REP.KOREA
24.	MUHA	WRC 25	INDIA	59.	NEANG MENH	WRC 58	CAMBODIA
25.	JHONA 2	WRC 26	INDIA	60.	NEANG PHTONG	WRC 59	CAMBODIA
26.	NEPAL 8	WRC 27	NEPAL	61.	HAKPHAYNHAY	WRC 60	LAOS
27.	JARJAN	WRC 28	BHUTAN	62.	RADIN GOI SESAT	WRC 61	MALAYSIA
28.	KALO DHAN	WRC 29	NEPAL	63.	KEMASIN	WRC 62	MALAYSIA
29.	ANJANA DHAN	WRC 30	NEPAL	64.	BLEIYO	WRC 63	THAILAND
30.	SHONI	WRC 31	BANGLADESH	65.	PADI KUNING	WRC 64	INDONESIA
31.	TUPA 121-3	WRC 32	BANGLADESH	66.	RAMBHOG	WRC 65	INDONESIA
32.	BINGALA	WRC 66	MYANMAR(BURMA)	67.	CHIN GALAY	WRC 97	MYANMAR(BURMA)
33.	PHULBA	WRC 67	INDIA	68.	DEEJIAOHUALUO	WRC 98	CHINA
34.	KHAO NAM JEN	WRC 68	LAOS	69.	HONG CHEUH ZAI	WRC 99	CHINA
35.	VANDARAN	WRC 100	SRILANKA	-	-	-	-
<i>O. glaberrima</i>							
1.	CG 14	-	SENEGAL	12.	TOG 6748	-	LIBERIA
2.	CG 17	-	SENEGAL	13.	TOG 6804	-	NIGERIA
3.	CG 20	-	SENEGAL	14.	TOG 7206	-	COTE D'IVOIRE
4.	TOG 12303	-	COTE D'IVOIRE	15.	TOG 7420	-	SIERRA LEONE
5.	TOG 5473	-	NIGERIA	16.	TOG 7442	-	NIGERIA
6.	TOG 5641	-	NIGERIA	17.	TOG 9066	-	NIGERIA
7.	TOG 5681	-	NIGERIA	18.	TOG 9276	-	NIGERIA
8.	TOG 5775	-	LIBERIA	19.	TOG 9280	-	NIGERIA
9.	TOG 5829	-	LIBERIA	20.	TOG 9281	-	NIGERIA
10.	TOG 6740	-	LIBERIA	21.	TOG 9300	-	NIGERIA
11.	SALIFOREH	-	SIERRA LEONE				

Table 2 Phenotypic frequency of vegetative vigor for both species in all ecosystems (%).

Ecologies Classes	Upland		Hydromorphic		Lowland	
	<i>O. sativa</i>	<i>O. glaberrima</i>	<i>O. sativa</i>	<i>O. glaberrima</i>	<i>O. sativa</i>	<i>O. glaberrima</i>
2010 season						
Extra vigorous	42.03	57.14	68.12	80.95	0	0
Vigorous	53.62	38.10	28.98	19.05	20.29	23.81
normal	4.35	4.76	2.90	0	71.01	71.43
weak	0	0	0	0	8.70	4.76
Very weak	0	0	0	0	0	0
2011 season						
Extra vigorous	43.48	61.90	43.48	71.43	5.80	9.52
Vigorous	47.83	38.10	43.48	28.57	39.13	38.10
Normal	8.70	0	13.04	0	55.07	52.38
Weak	0	0	0	0	0	0
Very weak	0	0	0	0	0	0

3 Results

Results of study revealed a typical bimodal Rainfall distribution pattern for the experimental site. During cropping season, lowest rainfalls were reported in July, 2010 cropping season while it was reported lowest in August of 2011 cropping season. Figure 1 showed rainfall distribution during crop seasons of 2010 and 2011.

Comparison between *O. glaberrima* and *O. sativa* was made for each variable in each ecosystem for both years. Vegetative vigor was scored between 1 (extra vigorous) to 5 (normal vigor) for *O. sativa* in all ecological conditions of both years for both cropping seasons. Therefore plant grown in upland ecological conditions shows higher vigorous characteristics (score 3) and shows 53.62 and 47.83 percent vigorous effect in 2010 and 2011 respectively. Highest vigorous percentages 68.12 and 43.48 were reported under hydromorphic ecological conditions of cropping season of 2010 and 2011 respectively. Under lowland ecosystem condition normal vigor showed

71.01% vigorous characteristics in 2010 while this percentage was reported 55.07% for the cropping season of 2011.

Vegetative vigor of *O. glaberrima* was reported between 1 (extra vigorous) to 3 (vigorous) for upland and hydromorphic ecologies. For *O. glaberrima*, vigorous nature was reported 95.24% for upland ecosystem conditions while this value reached 100% for hydromorphic agro-ecosystem and these two are not significantly different. This vigorous nature reached 100% for both the ecosystem in the second season. In lowland ecosystem, vegetative vigor was reported between 3 (vigorous) to 7 (weak) for *O. glaberrima* germplasm and the normal vigor had the high percentage 71.43% in 2010. While in 2011, it was scored between 1 (extra vigorous) to 5 (normal) and the normal vigor percentage was reported 52.38% (table 2). No significant difference was found between *O. sativa* and *O. glaberrima* for plant height at maturity in all studied agricultural agroecosystem both seasons. In lowland ecology ($P=0.544$), *O. glaberrima* showed 149.9 cm plant height and this value was reported 147.6 cm for *O. sativa*.

Table 3 Phenotypic Frequency of plant height for both species in all ecosystems (%).

Table 3: Phenotypic Frequency of plant height for both species in all ecosystems (%)						
Ecologies Classes	Upland		Hydromorphic		Lowland	
	<i>O. sativa</i>	<i>O. glaberrima</i>	<i>O. sativa</i>	<i>O. glaberrima</i>	<i>O. sativa</i>	<i>O. glaberrima</i>
2010 season						
Semi dwarf	20.29	0	13.04	0	10.14	0
Intermediate	26.09	42.86	17.39	14.29	11.59	4.76
Tall	53.62	57.14	69.57	85.71	78.26	95.24
2011 season						
Semi dwarf	36.23	28.57	26.09	14.29	7.25	0
Intermediate	44.93	61.90	50.72	57.14	4.35	0
Tall	18.84	9.52	23.19	28.57	88.41	100

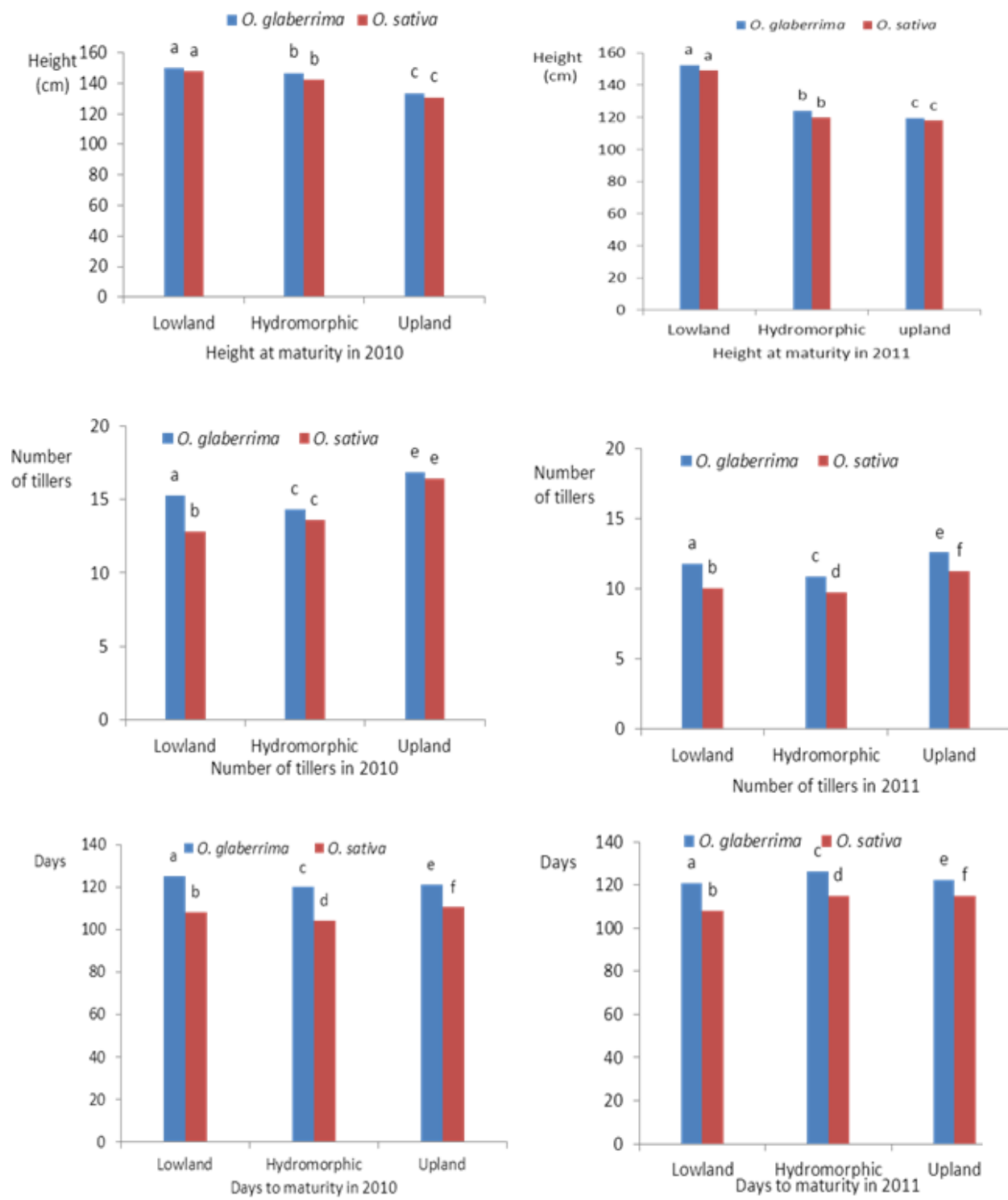


Figure 2 Comparison of *O. glaberrima* and *O. sativa* in all ecosystems

Table 4 Phenotypic frequency for tillers number for both species in all ecosystem (%).

Ecologies Classes	Upland		Hydromorphic		Lowland	
	<i>O. sativa</i>	<i>O. glaberrima</i>	<i>O. sativa</i>	<i>O. glaberrima</i>	<i>O. sativa</i>	<i>O. glaberrima</i>
2010 season						
Very high	2.90	0	1.45	0	0	0
Good	18.84	14.29	5.80	4.76	2.90	4.76
Medium	76.81	85.71	75.36	90.48	79.71	95.24
Low	1.45	0	17.39	4.76	17.39	0
Very low	0	0	0	0	0	0
2011 season						
Very high	1.45	0	0	0	0	0
High	1.45	4.76	0	0	1.45	0
Medium	66.67	80.95	47.83	80.95	49.28	80.95
Low	30.43	14.29	52.17	19.05	47.82	19.05
Very low	0	0	0	0	1.45	0

In hydromorphic ecosystem ($P=0.235$) this plant height was reported 146.67 cm for *O. glaberrima* and 142.24 cm for *O. sativa* while in upland ecology ($P=0.468$), *O. glaberrima* showed 133.26 cm and *O. sativa* gave 130.7 cm height. Further, in the second season, similar result was found for plant height and *O. glaberrima* and *O. sativa* (Figure 2).

Scores of plant height for *O. sativa* were comprised between 1 (semi dwarf) to 9 (tall) in both seasons in all ecologies. In first season, 53.62% genotypes of the *O. sativa* were tall in upland, while this value was reported between 69.57% for hydromorphic and 78.26% for lowland ecosystems. The second season showed majority of plants as intermediate in upland (44.93%) and hydromorphic (50.72%) while for In lowland ecosystem, 88.41% of the *O. sativa* plants were tall. Similar pattern was reported for *O. glaberrima* and 57.14% genotypes were tall for upland, while it was reported 85.71% for hydromorphic and 95.24% for lowland. In the second season of 2011, 61.90% *O. glaberrima* genotypes grown in the upland are tall, while this percentage was 57.14 and 100% for plant grown in hydromorphic and lowland ecosystem (Table 3).

In case of tillers number at maturity, a significant difference ($P<0.001$) was reported between *O. glaberrima* (15.32 tillers/plant) and *O. sativa* (12.80 tillers/plant) at lowland ecosystem in the first season of 2010. While, in case of upland ($P=0.250$) and hydromorphic ($P=0.489$), no significant difference was found between *O. glaberrima* and *O. sativa*. While, in the second season significant difference ($P<0.05$) was observed between *O. glaberrima* and *O. sativa* in all ecologies. Means values of *O. glaberrima* were higher as compared to *O. sativa*. Concerning the number of tillers, *O. glaberrima* have 11.78 tillers/plant in lowland while this number was 10.88 and 12.59 tillers/plant for hydromorphic and upland ecosystem respectively. In case of *O. sativa* genotypes, tiller number was 10.04, 9.71 and 11.21 tillers/plant for lowland, hydromorphic and upland respectively (Figure 1). The scores of tiller number in the first season were ranged from 1 (very high) to 7 (low) for *O. sativa* while, in case of *O. glaberrima* tiller number showed two classes viz 3 (good) and 5 (medium). Percentage tiller was reported 76.81, 75.36 and 79.71% for upland, hydromorphic and lowland ecosystem. Similar results were obtained in the second season of 2011 (Table 4).

Table 5 Phenotypic Frequency of days to maturity for both species in all ecosystem (%).

Ecologies Classes	Upland		Hydromorphic		Lowland	
	<i>O. sativa</i>	<i>O. glaberrima</i>	<i>O. sativa</i>	<i>O. glaberrima</i>	<i>O. sativa</i>	<i>O. glaberrima</i>
2010 season						
Very early	24.64	9.52	56.52	19.05	39.13	4.76
Early	56.52	33.33	28.99	14.29	44.93	23.81
Medium	8.70	28.57	5.80	38.10	7.25	28.57
Late	2.90	28.57	2.90	28.57	4.35	42.86
Very late	7.25	0	5.80	0	4.35	0
2011 season						
Very early	27.54	4.76	17.39	9.52	28.99	4.76
Early	36.23	14.29	44.93	14.29	49.28	23.81
Medium	20.29	52.38	23.19	33.33	13.04	57.14
Late	7.25	28.57	2.90	38.10	4.35	14.29
Very late	8.70	0	11.59	4.76	4.35	0

Table 6 Time courses of leaf area for both species in all ecologies (cm²).

	Upland			Hydromorphic			Lowland		
	31DAS	46DAS	56DAS	31DAS	46DAS	56DAS	31DAS	46DAS	56DAS
2010 season									
<i>O. glaberrima</i>	273.8	749.51	1182.7	335.27	629.2	1161	121.02	485.7	1108.4
<i>O. sativa</i>	229.8	557.55	935.65	251.04	490.5	906	79.33	305.4	875.4
Probability	0.018	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2011 season									
<i>O. glaberrima</i>	173.35	586.9	1022.3	94.01	492.8	715.9	41.67	397.98	1263.84
<i>O. sativa</i>	111.36	401.1	717.5	66.12	295.7	451.4	36.62	302.05	933.87
Probability	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.071	<0.001	<0.001

Like other parameters, maturity also showed highly significant difference ($P < 0.001$) between *O. glaberrima* and *O. sativa* for all ecologies in both seasons. In the first season, in lowland means values indicated 125.4 days for *O. glaberrima* and 108.4 days for *O. sativa*. Further, for *O. glaberrima* maturity time was reported 120 days under hydromorphic ecosystem and this duration was reported 104.4 days for *O. sativa* in under same ecosystem. Under upland ecosystem conditions, means maturity time was reported 121.3 days for *O. glaberrima* while this was reported 110.6 days for *O. sativa*. In 2011, no significant differences was reported amongst the various ecosystem and means maturity time under lowland condition was reported 121 days for *O. glaberrima* and 107.9 days for *O. sativa* while this maturing time was 126.4 days for *O. glaberrima* and 114.8 days for *O. sativa* under hydromorphic ecosystem. In upland ecosystem conditions, maturity time was reported 122.4 and 115 days for *O. glaberrima* and *O. sativa* respectively (Figure 1). Days to maturity was scored between 1 (very early) to 9 (very late) for *O. sativa* and between 1 (very early) to 7 (late) for *O. glaberrima* in all ecologies in both seasons. In the first season high percentage (56.52%) had early maturing class in upland and in lowland (44.93%) for *O. sativa* but for *O. glaberrima* high percentage (56.52%) was revealed by very early genotypes under hydromorphic ecosystem while high percentage in early maturing class 33.33% in upland ecology. In 2011 high percentage was observed in early maturing class at all ecologies and it was reported 36.23% in upland, 44.93% in hydromorphic and 49.28% in lowland for *O. sativa*. While, intermediate early maturity was reported for *O. glaberrima* in upland (52.38%) and lowland (57.14%) ecosystem but *O.*

glaberrima genotypes grown in hydromorphic ecosystem shows high percentage (38.10%) of late maturing (Table 5).

Table 6 shows time courses of leaf area for all ecologies tested in both seasons. An expansion in Leaf area was reported from 31 to 56 DAS for both *O. glaberrima* and *O. sativa*. The comparison of both species revealed that leaf area of *O. glaberrima* was higher than *O. sativa* on each sampling date. Same pattern was obtained in all ecologies in both seasons. Means of specific leaf area (SLA) decreased gradually between 31 and 56 DAS and uniform among ecologies for *O. glaberrima* and *O. sativa*. *O. glaberrima* had the greatest SLA whereas *O. sativa* had the smallest at each sampling date (Table 7).

4 Discussion

This is the first attempt to compare core collection of *O. sativa* to *O. glaberrima* under different hydrological conditions by using morpho-physiological and phenological variables. Present study has been taken for the whole diversity of *O. sativa* developed by Kojima et al (2005) in NIAS Institute in Japan. As per the Frankel (1984) suggestion, development of core collection is important for the effective uses of germplasms. High variability (1 to 7) was observed within the *O. glaberrima* and *O. sativa* vegetative vigor in all ecosystems. Plant height at maturity did not discriminate *O. glaberrima* and *O. sativa* as shown by non-significant probability. Semi dwarf, intermediate and tall genotypes were reported in both species. In the each ecosystem, plant height is not discriminate variable.

Table 7 Time courses of specific leaf area for both species in all ecologies m²kg⁻¹.

	Upland			hydromorphic			lowland		
	31DAS	46DAS	56DAS	31DAS	46DAS	56DAS	31DAS	46DAS	56DAS
2010 season									
<i>O. glaberrima</i>	37.22	30.68	21.86	36.50	29.95	22.70	37.6	30.38	22.53
<i>O. sstiva</i>	27.54	22.76	17.09	26.96	21.98	17.07	26.97	21.37	18.67
Probability	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001
2011 season									
<i>O. glaberrima</i>	37.25	30.22	24.13	36.31	28.76	22.39	35.79	29.33	21.53
<i>O. sativa</i>	30.01	25.22	20.22	32.75	25.15	20.86	32.07	26.15	18.67
Probability	<0.001	<0.001	<0.001	0.009	<0.001	0.019	0.002	<0.001	<0.001

On the other hand number of tillers at maturity, maturity time, leaf area and specific leaf area discriminate well for *O. glaberrima* and *O. sativa*. High tillers number was observed in all geographical area for *O. glaberrima* in 2011. Similarly, Dingkuhn et al. (1998) reported about twice tillage production in *O. glaberrima* (CG 14) as compared to *O. sativa* (WAB 56-104) under upland condition. High tillering capacity is considered as desirable trait in rice production since number of tillers per plant is closely related to number of panicle and grain yield (Wang et al., 2007). Comparison of means days of maturity between *O. glaberrima* and *O. sativa* revealed highly significant difference in all ecosystems.

Result of study revealed that *O. sativa* had shorter duration as compared to *O. glaberrima*. High variability was reported in days to maturity for both species from very early to very late maturing. Crop duration is interactively determined genotype and environment. Crop duration of rice genotype varied strongly in their sensitivity to photoperiod. It depends mainly on the cultivar-specific duration of the basic vegetative phase (Dingkuhn & Asch, 1999).

Comparison between rice cultivars of different ecological adaptation which were planted across hydrological sequence indicated strong genotype specific effects of the ecosystem on growth and crop duration (Dingkuhn & Asch, 1999). This study did not go depth to make difference between *O. sativa japonica* and *O. sativa indica* because core collection comprises both subspecies. Therefore it has been well established that *O. sativa indica* has long crop duration and high tillering ability. Similarly, Dingkuhn & Asch (1999) reported long crop duration under all studied ecologies (upland, hydromorphic and lowland) for *O. sativa indica* cultivar (Bouake 189) and it was longer than the *O. glaberrima* (CG 14). While the other genotype of *O. sativa japonica* cultivar (WAB 56-105) has shorter crop duration as compared to CG 14. This thing is suggesting that results can vary with the used genotypes.

Special leaf area gradually (SLA) increased between 31 to 56 DAS for *O. glaberrima* and *O. sativa*. Moreover *O. glaberrima* achieve superior SLA as compared to *O. sativa*. SLA has previously been found higher for *O. glaberrima* than *O. sativa* (Dingkuhn et al., 1998; Asch et al., 1999; Dingkuhn et al., 1999; Moukoumbi et al., 2011). SLA despite being a parameter that is strongly affected by sampling date discriminate well *O. glaberrima* and *O. sativa*. A high SLA reduces the amount of assimilates needed to produce a given leaf area, resulting in early ground cover, and therefore a greater light harvest and higher canopy photosynthesis rates early in the season (Dingkuhn et al., 1999). SLA has been shown highly predictive and positive correlation was found with weed competitiveness (Dingkuhn et al., 1999). It is an excellent criterion of breeding for weed competitive. Droopiness of the leaves of many accessions of *O. glaberrima* caused the highest of SLA (Dingkuhn et al., 1998).

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Conflict of interest

Authors would hereby like to declare that there is no conflict of interests that could possibly arise.

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