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IDENTIFICATION OF SUBMERGENCE TOLERANT RICE GENOTYPES WITH REFERENCE TO LEAF PHYSIOLOGY

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ABSTRACT

The experiment was carried out at the research farms and plant physiology laboratory of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during aman season of 2014 to study the response of different rice genotypes to submergence condition and to identify submergence tolerance of aman rice genotypes best on leaf physiological parameters. The experiment was conducted with three tolerant (BRRI dhan52, IR64Sub1, FR13A) and one susceptible genotype (BR5) with four submergence treatments (0, 7, 14, and 21 days of submergence). The experiment was laid out in two factors randomized complete block design with four replications. Different leaf physiological processes were hampered due to submergence. The negative effect of submergence was increased with increasing submergence duration. But there was genotypic variation in every submergence level. After desubmergence the relative water content, stomatal conductance, transpiration rate, intercellular CO_2 concentration, net assimilation rate and specific leaf weight were less affected in BRRI dhan52 and FR13A and were more affected in IR64Sub1 and in BR5. Considering different leaf physiological processes BRRI dhan52 showed more submergence tolerance compared to other genotypes.

Keywords: leaf physiology, net assimilation rate, relative water content, stomatal conductance, submergence

INTRODUCTION

Rice (*Oryza sativa* L.) is the staple food for more than half of the world's population. It is the major crop in most flood prone areas of South and South-East Asia including Bangladesh. There is a tremendous pressure for increasing rice production in order to keep pace with population growth in the world. By the year 2035, 26% increase in rice production will be necessary to feed the rising population (Seck *et al.*, 2012). The intensity of rainfall is extremely high in many monsoon areas of the world. There the rice plant is completely flooded for a period ranging from a day to several weeks. This kind of inundation is generally known as "submergence". Submergence is one of the major constraints for rice production in Bangladesh along with many rice growing countries of the world. The soil and overlying water of flooded habitats are characterized by hypoxia and anoxia, the partial and complete depletion of oxygen, respectively. The negative impacts of submergence on rice plant are mainly related to low light intensity, slow gas diffusion (10,000 times slower in water than air) and changes in root environment including the accumulation of phytotoxic compounds (Gambrell *et al.*, 1991; Bailey-serres and Voesenek, 2008).The submergence effect on rice plant also depends on water depth, duration of submergence, turbidity of water, light intensity, O_2 concentration of water, pH of water, water temperature and age of the plant (Sarkar *et al.*, 2006).Under submerged condition, rice plants usually face reduced ATP production by rapid alcoholic fermentation, limited photosynthesis, carbohydrate starvation, degradation of chlorophyll and mechanical damage (Ella *et al.*, 2003). After desubmergence, on the other hand, plants face aerobic shock induced photoinhibition, production of reactive oxygen species and accumulation of acetaldehyde (Luo *et al.*, 2009).

Tolerant to flash flood submergence may be defined as "the ability of a rice plant to survive from 10 to14 days of complete submergence and renew its growth when the water subsides" (Catling, 1992). Rice varieties differ in their tolerance to submergence. Under flash flooding, few leaf characters have been identified as playing a key role in submergence tolerance in rice. Different leaf physiology such as relative water content, stomatal conductance, transpiration rate, intercellular CO_2 concentration, net

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assimilation rate and specific leaf weight might play ctitical role after desubmergence. Separately, after desubmergence, tissue injuries which developed underwater can be intensified as the floodwater recedes and shoots become re-exposed to the atmosphere (Sarkar *et al.*, 2006). The photosynthetic carbon fixation and accumulation of carbohydrate are essential for biomass accumulation during submergence and after desubmergence. However, it was also reported that sudden increase in light intensity upon de-submergence threatens leaves accustomed to low-light underwater environments, causing photoinhibition to the photosynthetic apparatus (Osmond, 1994; Ella *et al.*, 2003). For example, submergence increased minimal fluorescence in leaves of rice cultivars, which signifies photoinhibition (Panda *et al.*, 2006).

It was observed that the main cellular components susceptible to damage by free radicals are membrane lipids (peroxidation of unsaturated fatty acids), proteins (denaturation), carbohydrate and nucleic acids (Blokhina *et al.*, 2003). ROS can be generated under hypoxic conditions during submergence; severe lipid peroxidation by ROS can have a fatal consequence in submerged plants (Santosa *et al.*, 2007). It was reported that the production of ROS is far more intensified upon de-submergence, which is associated with an abrupt and concomitant increase in light intensity and O_2 concentration. Excessive formation of ROS is commonly found in plants re-exposed to the ambient conditions following submergence (Blokhina *et al.*, 2003; Bailey-Serres and Chang, 2005; Santosa *et al.*, 2007). It was indicated that re-aeration can induce a transient burst of acetaldehyde emission (Zuckermann *et al.*, 1997; Tsuji *et al.*, 2003) as a result of rapid ethanol oxidation without coordinated oxidation of acetaldehyde (Boamfa *et al.*, 2005). It was observed that when the floodwater recedes, low hydraulic conductivity of submerged roots cannot provide enough water to meet aboveground transpirational demand, causing wilting of shoot (Luo *et al.*, 2009). However, to our knowledge, no study has conducted to find the transpiration rate of rice genotypes after desubmergence.

Debabrata and Kumar (2011) also stated that stomatal conductance found to be significantly decreased in both Swarna and Swarna *Sub1* during the progression of submergence as compared to control plant. They also found that after 7 days of submergence stomatal conductance significantly more in Swarna *Sub1* compared to Swarna. Closing of stomata, with or without leaf dehydration, reduction of transpiration and inhibition of photosynthesis, are responses that can occur in hours or days, depending on the tolerance to flooding of each plant species (Bradford & Hsiao, 1982; Else *et al.*, 1996; Insausti *et al.*, 2001; Striker *et al.*, 2005; Mollard *et al.*, 2008; Mollard *et al.*, 2010). Sakagami *et al.* (2009) found that the photosynthetic rate at 37 Days after submergence in partial and complete submergence was closely related to the net assimilation rate (NAR) during submergence in the pot experiment. According to Sarkar *et al.* (2006), "submergence tolerance is a metabolic adaptation in response to anaerobiosis that enables cells to maintain their integrity so that the plant survives hypoxia without major damages". Therefore, the ultimate goal of the present study is to find out the leaf characters those help in submergence tolerance.

MATERIALS AND METHODS

The pot experiment was conducted at the research farm and Plant Physiology Laboratory, Dept. of Agricultural Botany, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh. The research area was located under the Agro-ecological zone of Madhupur Tract (AEZ 28) which was in 23°77'N latitude and 90°33'E longitude at an altitude of 9m above the sea level (BCA, 2004). The duration of the experiment was July to November (aman season) of 2014. The climate of this area is sub-tropical. The soil used in this experiment was deep red brown terrace soil under Tejgaon series. The textural class of the soil was silty loam. The experiment was conducted in two factors randomized complete block design with four replications. (I) Factor A- Submergence durations: i) 0 day under water or control (no submergence) ii) 7 days under water iii) 14 days under water iv) 21 days under water (II) Factor B-Rice genotypes:i) BRRI dhan52 ii) IR 64 sub1 iii) FR 13A (tolerant check) iv) BR5 (susceptible check).Seeds were collected from the gene bank of Bangladesh Rice Research Institute (BRRI), Joydebpur, Gazipur. The seeds were treated and germinated in seed bed. The seedlings were raised for 30 days in the seed beds. Sufficient earthen pot was taken as per treatment, replication and data collection. Each pot contained 10kg of pot soil with recommended fertilizer. Each pot was tagged with enamel paint. Thirty-days-old seedlings were transplanted to the pots. Each pot contained one healthy seedling only. The seedlings were transplanted immediately after uprooting from the seed bed. Different intercultural operations were done. A concrete submergence tank was prepared and the water level was checked daily. After 10 days of transplanting when the seedlings were well established in the pot soil then all the pots except control treatments (no submergence) were placed inside the tank and the water level was gradually increased up to 125 cm. The pot containing plants were submerged for different days (7 days, 14 days and 21 days) as per treatments. The water was made turbid daily by mixing mud. Different data was collected just after desubmergence, at anthesis and at harvest. The stomatal conductance of main stem flag leaf was measured by leaf porometer (G9-Leaf Porometer, model: SC-1, USA). The transpiration rate, intercellular CO_2 concentration and net assimilation rate were measured by 'LCpro+ photosynthesis gas exchange system' (model: LI-6400XT, USA). The data were analyzed in two factor randomized complete block design and the means were separated by DMRT at 5% level of significance using the statistical computer package programme MSTAT-C (Russell, 1986).

RESULTS AND DISCUSSION

Specific leaf weight

Specific leaf weight (SLW) is defined as the mass of leaf dry matter per unit of leaf area. The plant with higher SLW (thick leaf) possesses more mesophyll cells for photosynthesis. The SLW of different rice genotypes was calculated after desubmergence from submerged and control plants (Table 1). Under control treatment, the SLW found was the highest in IR64Sub1 and the lowest in BRRI dhan52. Due to 7 DS treatment, the submergence treated plants produced lower SLW compared to control treatment in all the genotypes. Among the 7 DS treated plants, the lowest (81.09% of the control) SLW recorded was in BRRI dhan52 and the highest ((92.61% of the control) recorded was in IR64Sub1. Due to 14 DS treatment, submergence treated plants produced lower SLW compared to control plants in all the genotypes. In this (14 DS) treatment, the highest (81.70% of the control) SLW recorded was in IR64Sub1 and the lowest (75.06% of the control) SLW recorded was in BRRI dhan52. Due to 21 DS treatment, submergence treated plants produced lower SLW compared to control plants in all the genotypes. Among this treatment (21 DS) plants, the highest (75.30% of the control) SLW recorded was in IR64Sub1 also and the lowest (49.69% of the control) in BR5. The SLW was more affected due to submergence in BR5 and less affected in IR64Sub1.

Table 1. Effect of different submergence treatments on specific leaf weight (SLW) of different rice genotypes

Genotypes	SLW under 7 DS mg/cm^2		SLW under 14 DS mg/cm^2		SLW under 21 DS mg/cm^2	
	C	S	C	S	C	S
BRRI dhan52	3.86 ab	3.13 c (81.09)	4.01 b	3.01 e (75.06)	4.25 b	2.69 d (63.29)
IR64Sub1	4.33 a	4.01ab (92.61)	4.70 a	3.84 b (81.70)	4.94 a	3.72 c (75.30)
FR13A	4.31 a	3.46 bc (80.28)	4.59 a	3.30 d (71.90)	4.71 a	2.49 d (52.87)
BR5	4.16 ab	3.62 a-c (87.02)	4.71 a	3.56 c (75.58)	4.91 a	2.44 d (49.69)
LSD(0.05)	0.64		0.24		0.31	
CV (%)	11.24		4.03		5.55	

DS= Days of submergence, (C = Control. S= Submergence, Figures inside the parenthesis indicate relative to control), Values followed by same letter(s) are not significantly different from each other by DMRT at 5% level for each treatment.

In the present experiment, the SLW recorded was lower than the control in all the genotypes and this was due to increased leaf area and decreased leaf dry matter under submergence condition. But 7 DS treatment in IR64Sub1 and BR5 showed statistically similar SLW as the control treatment. Decrease in SLW means reduction of tissue available in a unit leaf area indicating the sensitivity of a genotype under submergence stress as BR5. Sarkar *et al.* (1996) found that after 9 days of submergence, the reduction of SLW for different varieties of rice was continuous and very high in susceptible varieties (50-51 %) as compared with the tolerant cultivars (12-18 %). As SLW is an index of photosynthesis in rice and chlorophyll is directly related to photosynthesis, it is suggested that better survival of tolerant varieties was due to the capability of synthesizing and maintaining more photosynthates during the period of submergence. Bailey-Serres and Voesenek (2008) also found that leaves of *Rumex palustris* developed under water were 20% thinner with an increased SLA indicating a larger surface area relative to mass. Therefore, it is suggested that IR64Sub1 genotype showed submergence tolerance considering this parameter.

Relative water content (RWC) of leaves

The relative water content of leaf was calculated after 2 hours of desubmergence both from control and submerged plants and the results have been shown in Fig. 1. In all the submergence treatments, it was recorded that the relative water content was significantly the highest at the control treatment compared to submergence treatment. Under 7 DS treatment, the relative water content of leaves was much higher in control treatment than the submerged treatment, in all the genotypes. Among the genotypes under 7 DS treatment, the highest (93.21%) relative water content of leaf recorded was in FR13A at control plant which was statistically similar to IR64Sub1, BRRI dhan52 and BR5 at control treatment and the lowest (64.12%) relative water content of leaf recorded was in BR5 at submerged plant which was significantly lower than any other genotype of this treatment. Under 14 DS treatment, the relative water content of leaf recorded was higher in control plants than the submerged plants in all the genotypes. Among the genotypes under this treatment, the relative water content of leaf recorded was the highest (93.41%) in FR13A at control plant which was statistically similar to IR64Sub1, BRRI dhan52 and BR5 at control treatment and the lowest (40.11%) recorded was in submerged plants of BR5 genotype which was significantly lower than any other genotype of this treatment. Under 21 DS treatment, the relative water content of leaf recorded was also higher in control plants than the submerged plants in all the genotypes. Among the genotypes under this treatment, the RWC of leaf found was the highest (93.51%) in IR64Sub1 at control plants which was statistically similar to BRRI dhan52, FR13A and BR5 at control treatment and the lowest (21.35%) recorded was in BR5 at submerged plant which was significantly lower than any other genotype of this treatment. A drastic reduction in RWC of leaf recorded was in BR5 at 21 DS treatment.

Under 7, 14 and 21 DS treatment the RWC of BRRI dhan52 and FR13A was relatively higher than the other genotypes. In the present experiment, the RWC was decreased significantly in submergence treatment compared to control in all the genotypes and the lowest RWC was recorded in BR5 in all the treatments. This might be due to transpiration rate was increased after desubmergence because of sudden high light and high heat. A sort of water stress (deficiency) was also created in the affected tissue (Fukao *et al.*, 2011). The water stress is related to fall in root hydraulic conductance of the plant. Under submerged condition, the membranes of the root cells were injured and root membrane permeability to water absorption were hampered. The injured root cannot supply enough water to the leaf to meet that transpirational demand. As a result plants fall in drought stress and the RWC of leaf become lower (Banerjee *et al.*, 2015). In this situation, plants try to maintain higher RWC through osmotic regulation by accumulating proline. It was also recorded in the present experiment that the RWC of leaf was closely related to the membrane injury level of the leaf in a certain treatment. The RWC of leaf was lower in those treatments where the membrane injury recorded was higher. The severe injured leaf tissues (in BR5 at 21 DS treatment) might unable to maintain osmotic adjustment under water stress condition. The lowest RWC in submerged leaf of BR5 indicated that this genotype is more susceptible to submergence stress than the other genotypes. In this situation, the genotype (such as FR13A) in which the RWC of leaf remain closer to control by accumulating more proline (data not shown), is suppose to be tolerant type.

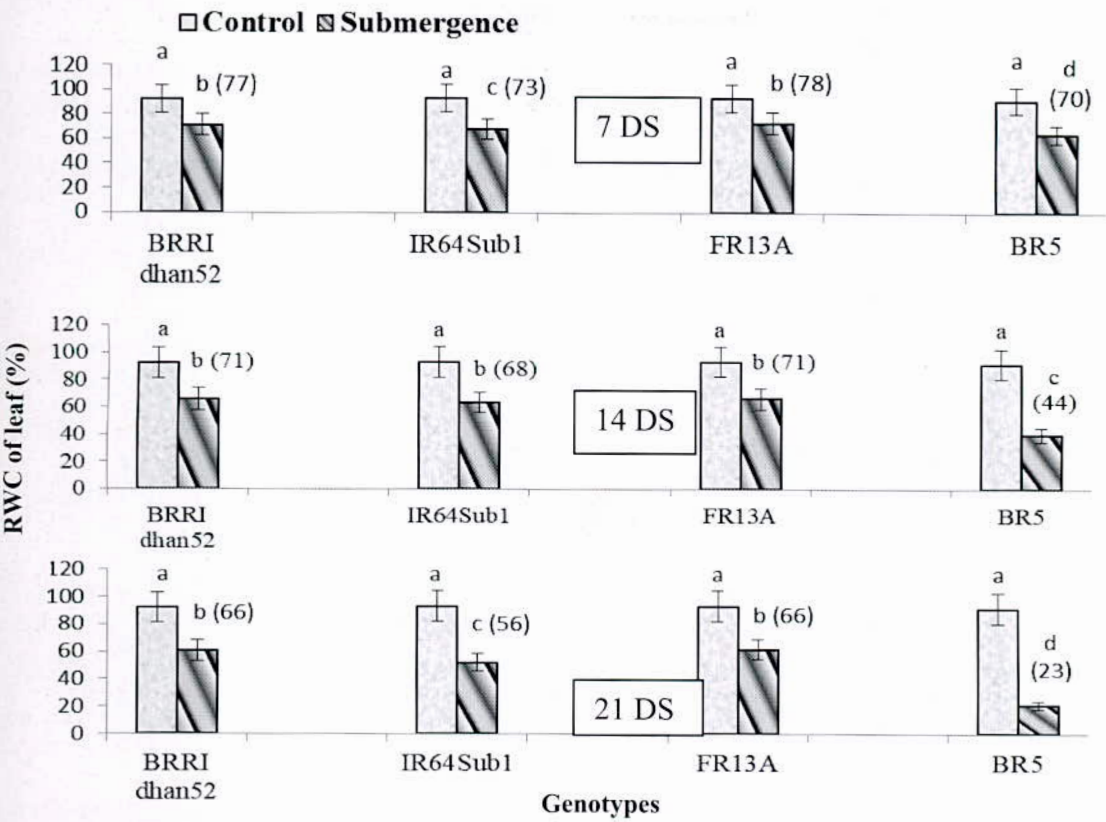

Fig. 1. Relative water content of leaf after desubmergence of submerged plants and control plants. Bar represents standard deviation. DS= Days of submergence, figures inside the parenthesis indicate values relative to control.

Stomatal conductance and transpiration rate

The major role of the stomata is to allow entry of CO_2 into the leaf for photosynthesis while at the same time preventing excessive water loss. The stomatal conductance and transpiration rate in flag leaf of main stem were measured by gas exchange meter during grain filling period and the average values were taken for analysis where all plants found dead at 21 days treatment of BR5. In all the genotypes, the stomatal conductance of control treatment recorded was higher compared to submergence treatment. The stomatal conductance gradually decreased with the increasing submergence duration in all the genotypes (Table 2). Considering all the genotypes and submergence durations, the stomatal conductance recorded was the highest (533 μmol m^{-2} s^{-1}) in BRRI dhan52 at 0 DS treatment which was statistically higher than any other treatment. The lowest (130 μmol m^{-2} s^{-1}) stomatal conductance recorded was in IR64Sub1 at 21 DS treatment which was significantly lower than any other treatment. Debabrata and Kumar (2011) found that stomatal conductance was significantly decreased in both Swarna and Swarna *Sub1* during the progression of submergence as compared to the control plant. They also found that after 7 days of submergence, stomatal conductance was significantly higher in Swarna *Sub 1* compared to Swarna. The genotype which maintained higher stomatal conductance after desubmergence might tolerant type.

The transpiration rate in FR13A recorded was the highest (7.425 mmol m^{-2} s^{-1}) at control treatment then gradually decreased with the increase of submergence duration. But in rest of the genotypes the transpiration rate recorded was little higher at 7 DS treatment than the control and then gradually decreased with the increasing submergence durations. Among the genotypes and submergence levels, the transpiration rate recorded was the highest (7.560 mmol $m^{-2} s^{-1}$) in BRRI dhan52 at 7 DS treatment which was statistically similar to those at 0 DS treatment in the same genotype. The lowest (4.790 mmol $m^{-2} s^{-1}$) transpiration rate recorded was in BR5 at 14 DS treatment which was statistically similar to IR64Sub1 at 21 DS treatment. In BRRI dhan52, IR64Sub1 and in BR5, the maximum transpiration recorded was at 7 DS treatment. In FR13A, the maximum transpiration was recorded at control treatment. In the present experiment, the stomatal conductance of FR13A at 7 DS treatment was statistically similar to the control treatment which might help this genotype to perform better. The decrease in stomatal conductance and transpiration rate in submerged treated plant compared to control plant might be due to decrease in chlorophyll content and increase in leaf injury. At physiological level, flooding modifies water relations and plants carbon fixation. Closing of stomata, with or without leaf dehydration, reduction of transpiration and inhibition of photosynthesis, are responses that can occur in hours or days, depending on the tolerance to flooding of each plant species (Bradford and Hsiao, 1982; Else *et al*., 1996; Insausti *et al*., 2001; Striker *et al*., 2005; Mollard *et al*., 2008; 2010). Above study suggested that 7 DS had little effect on BRRI dhan52.

Table 2. Average of stomatal conductance and transpiration rate of flag leaf during grain filling of different rice genotypes as influenced by different submergence treatments

Genotypes	Days of submergence (DS)	Stomatal conductance (µmol $m^{-2} s^{-1}$)	Transpiration rate (m mol $m^{-2} s^{-1}$)
BRRI dhan52	0	533 a	7.56 a
	7	340 b	7.56 a
	14	323 b	7.24 bc
	21	242 cd	7.29 a-c
IR64Sub1	0	330 b	6.56 d
	7	275 c	7.01 c
	14	275 c	6.20 e
	21	130 e	4.91 g
FR13A	0	250 cd	7.43 ab
	7	245 cd	6.49 d
	14	237 cd	6.06 e
	21	220 d	6.31 de
BR5	0	265 cd	5.72 f
	7	245 cd	5.73 f
	14	217 d	4.79 g
	21	-	-
CV (%)		10.47	3.20

In a column, values followed by same letter(s) are not significantly different from each other by DMRT at 5% level of significance.

Intercellular CO_2 concentration and net assimilation rate

The intercellular CO_2 concentration and net assimilation rate of flag leaf of main stem were also measured by gas exchange meter during grain filling period and the average values were recorded for analysis where all plants found dead at 21 DS treatment of BR5. Considering all the genotypes and submergence durations, the intercellular CO_2 concentration found was the highest (354.75) µmol ($m^{-2} s^{-1}$) in FR13A at 7 DS treatment (Table 3). The lowest (307 µ mol $m^{-2} s^{-1}$) intercellular CO_2 concentration recorded was in BRRI dhan52 at 0 DS treatment. In BRRI dhan52, the highest intercellular CO_2 concentration was recorded at 21 DS treatment which was significantly higher than control treatment. In IR64Sub1, the highest intercellular CO_2 concentration recorded was at 14 DS condition which was statistically similar to the other treatments of the same genotype. In FR13A, the highest intercellular CO_2 concentration recorded was at 7 DS which was statistically similar to the other treatments of the same genotype and in BR5, the highest intercellular CO_2 concentration recorded was also in 14 DS treatment, which was significantly higher than the control and 7 DS treatment.

Net assimilation rate is a useful measure of the photosynthetic efficiency of plants. Net assimilation rate is the rate of increase of dry weight per unit of leaf area. Considering all the genotypes and submergence durations, the highest (14.08 μ mol m^{-2} s^{-1}) net assimilation rate recorded was in BRRI dhan52 at 0 DS treatment which was statistically similar to 7 DS treatment in the same genotypes, where the intercellular CO_2 concentration was in the lowest level. Among the genotypes and submergence levels, the lowest (4.96 μ mol m^{-2} s^{-1}) net assimilation rate recorded was in IR64Sub1 at 21 DS treatment which was significantly lower than any other treatment.

In all the genotypes, submerged plants showed lower net assimilation rate than control plant, though the 7 DS treatment of BRRI dhan52, 7 and 14 DS treatment of BR5, showed statistically similar NAR with control treatment. The intercellular CO_2 concentration was increased with the increasing submergence duration in all the genotypes; exhibiting the lower CO_2 fixation rate. Lower net assimilation rate and higher intercellular CO_2 concentration under submergence condition indicated that photosynthetic enzyme such as RuBP carboxylase might had some limitation to fix CO_2. So the lower stomatal conductance and higher intercellular CO_2 concentration might contributed in lower net assimilation rate in submergence treated plants. Panda and Sarkar (2012) stated that due to submergence three functional steps of photosynthetic reaction center, namely absorption of light energy, trapping of the excitation energy and the conversion of excitation energy to electron transport were affected, which ultimately affected the photosynthesis as well as net photosynthesis. They also stated that both donor and acceptor sides of PS II were damaged, electron transport perturbed, connectivity between the antennae of PS II lost which resulted in the fall of CO_2 photo-assimilation rate. The structural and functional damage of PS II was more prominent in susceptible cultivars. Sakagami *et al.* (2009) found that complete submergence adversely affected leaf area and photosynthesis.

In the present experiment, the SLW was recorded lower than the control in all the genotypes. But 7 DS treatment in IR64Sub1 and BR5 showed statistically similar SLW as the control treatment. But, further increase in submergence duration the SLW was recorded lower and thinner leaf under submergence indicated the sensitivity of a genotype as in BR5. Under 7, 14 and 21 DS treatment the RWC of BRRI dhan52 and FR13A was relatively higher than the other genotypes. In the present experiment, the RWC was decreased significantly in submergence treatment compared to control in all the genotypes and the lowest RWC was recorded in BR5 in all the treatments. In all the genotypes, the stomatal conductance of control treatment was recorded higher compared to submergence treatment. The stomatal conductance gradually decreased with the increasing submergence duration in all the genotypes. The transpiration rate in FR13A recorded was the highest (7.425 mmol m^{-2} s^{-1}) at control treatment then gradually decreased with the increase of submergence duration. But in rest of the genotypes the transpiration rate recorded was little higher at 7 DS treatment than the control and then gradually decreased with the increasing submergence durations. Considering all the genotypes and submergence durations, the intercellular CO_2 concentration found was the highest (354.75 μmol m^{-2} s^{-1}) in FR13A at 7 DS treatment (Table 3). The lowest (307 μmol m^{-2} s^{-1}) intercellular CO_2 concentration recorded was in BRRI dhan52 at 0 DS treatment. In BRRI dhan52, the highest intercellular CO_2 concentration was recorded at 21 DS treatment which was significantly higher than control treatment. In all the genotypes, submerged plants showed lower net assimilation rate than control plant, though the 7 DS treatment of BRRI dhan52, 7 and 14 DS treatment of BR5, showed statistically similar NAR with control treatment.
The present study indicated that different leaf physiological processes were hampered due to submergence in all the genotypes; but there existed genotypic variations. The 7 DS treatment did not create any significant and harmful effect on BRRI dhan52. The genotype FR13A also performed better after desubmergence.

Table 3. Average of intercellular CO_2 concentration and net assimilation rate of flag leaf during grain filling of different rice genotypes as influenced by different submergence treatments

Genotypes	Days of submergence (DS)	Intercellular CO_2 concentration (μ mol mol^{-1})	Net assimilation rate (μ mol m^{-2} s^{-1})	
			Actual	Relative to control (%)
BRRI dhan52	0	307.00 g	14.08 a	100
	7	320.75 d-g	13.75 a	98
	14	320.75 d-g	10.31 c	73
	21	337.25 b-d	8.26 e	59
IR64Sub1	0	325.25 c-f	11.93 b	100
	7	325.50 c-f	10.60 c	89
	14	333.50 b-e	10.285 c	86
	21	325.75 c-f	4.96 f	42
FR13A	0	340.25 a-c	12.46 b	100
	7	354.75 a	10.30 c	83
	14	347.75 ab	9.78 cd	79
	21	340.50 a-c	9.11 de	73
BR5	0	314.00 fg	10.72 c	100
	7	325.00 c-f	10.66 c	99
	14	347.50 ab	9.84 cd	92
	21	-	-	-
CV (%)		3.43	7.59	

In a column, values followed by same letter(s) are not significantly different from each other by DMRT at 5% level of significance.

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