***Original Research Article***

**Influence of salinity on morpho-phenological parameters of rice genotypes (*Oryza sativa* L.)**

**ABSTRACT**

A field experiment was conducted during the *Kharif* seasons of 2021 and 2022 at the Agricultural Research Station (ARS), Gangavathi, under the University of Agricultural Sciences, Raichur, Karnataka, to evaluate the Influence of salinity on morpho-phenological parameters of rice genotypes (*Oryza sativa* L.). The site had saline soil conditions with pH values of 8.13 and 8.17, and electrical conductivity (ECe) of 10.90 and 10.77 dSm⁻¹ in 2021 and 2022, respectively. Thirty-six genotypes, including four checks, were evaluated using a randomized block design with two replications. Significant variation was observed among genotypes for morpho-phenological traits such as plant height, tiller number, leaf area, leaf area index, dry matter accumulation, days to 50% flowering and days to physiological maturity. Salinity stress reduced growth, suppressed tillering, decreased biomass, and delayed flowering and maturity in sensitive genotypes due to osmotic stress, ion toxicity, and disrupted physiological processes. In contrast, tolerant genotypes maintained growth through mechanisms like osmotic adjustment and ion compartmentalization. Based on performance, genotypes were categorized as highly tolerant (9), tolerant (8), moderately tolerant (12), sensitive (4), and highly sensitive (3). The tolerant groups offer potential for cultivation in salt-affected. Genotypes IET 28608, CSR23, FL478, GNV 1801, GNV 1109, CSR 22, CSR10, SIRI 1253, and GNV 1806, can be used as source of salinity tolerance for crop improvement programs.

*Keywords: EC, Genotypes, Nutrient uptake, Photosynthetic efficiency, pH, Salinity stress,*

**1.INTRODUCTION**

Rice (*Oryza sativa* L.) is one of the world’s most important staple crops, serving as a primary calorie source for over half of the global population (Swaminathan, 1984). Of the 24 known species in the genus *Oryza* (2n = 24), *O. sativa* and *O. glaberrima* are the two cultivated types. According to USDA (2024), global rice production in 2023/24 is projected at 515.53 million metric tons (milled basis), cultivated over 165.98 million hectares. India contributes approximately 134 million metric tons from 48 million hectares, with major rice-growing states including West Bengal, Punjab, Uttar Pradesh, Andhra Pradesh, Bihar, Madhya Pradesh, Tamil Nadu, Telangana, and Karnataka. With a rising global population and limited scope for expanding cultivation areas due to urbanization and climate change, improving rice productivity is essential. To meet future food demands, yields must increase by 1.2–1.5% annually, adding 8–10 million tons of rice each year-particularly in densely populated nations like India (USDA, 2024).

Salinity stress affects various cellular processes caused by the alterations in the variety of genes expression profiles with divergent functions in response to high salinity (Kojima et al., 2004). Primarily, salinity stress negatively affects plant growth through osmotic stress and ionic stress (Munns, 2005). During the initial phases of salinity stress, water absorption capacity of root systems decreases and water loss from leaves is accelerated due to osmotic stress of high salt accumulation in soil and plants, and therefore salinity stress is also considered as hyperosmotic stress. Osmotic stress causes dehydration of plant cells because of the lower osmotic potential generated by high salt concentration in soils osmotic stress, which is created by the accumulation of ions in the rhizosphere is the first effect of the salt stress which limits the water extraction by the roots that eventually leads to reduction in plant growth. In addition, ionic stresses induced by excess accumulation of Na+ disrupts cellular ion homeostasis and metabolism. High Na+ concentration in soils can also inhibits the absorption of potassium (K+) an essential nutrient, by the roots (Wakeel, 2013). One of the most detrimental effects of salinity stress is the accumulation of Na+ and Cl− ions in tissues of plants exposed to soils with high NaCl concentrations. Entry of both Na+ and Cl− into the cells causes severe ion imbalance and excess uptake might cause significant physiological disorders. High Na+ concentration inhibits uptake of K+ ions which is an essential element for growth and development that results into lower productivity and may even lead to death, in addition increased production of reactive oxygen species (ROS) known as oxidative stress, occurs as a secondary effect of high salinity (Sharma et al., 2012). Water deficit induce stomatal closure of the plants which in turn causes reduction in CO2 starvation (Ueda et al., 2013). Consequently, decreased consumption of reduction power triggers ROS generation in the chloroplast, leading to damage of photosynthetic machinery that may irreversibly affect the photosynthetic activity (Perez et al., 1995). Physiological lethal effects of salt stress include reduction of leaf expansion, photosynthetic area and dry matter production.

Among the abiotic stresses threatening rice productivity, salinity is one of the most detrimental, especially in arid, semi-arid, and coastal regions. Salinity adversely affects plant growth and development through osmotic stress, ion toxicity, and nutrient imbalance, impairing key morpho-physiological and phenological traits that directly influence yield. Understanding genotypic responses to salinity is crucial for developing salt-tolerant cultivars. Morphological traits such as plant height, tiller number, leaf area, and leaf area index (LAI) reflect vegetative growth and canopy structure, which impact photosynthesis and biomass production. Likewise, crop growth rate (CGR) and dry matter distribution in leaves, stems, and panicles provide insight into physiological efficiency and source-sink dynamics under stress. Phenological traits like days to 50% flowering and physiological maturity are vital indicators of developmental progress and adaptability to salinity. Stress-induced changes in these stages may influence grain filling and harvest index.

This study evaluates the effects of salinity on key morpho-phenological traits in diverse rice genotypes. By analysing variation in growth, biomass accumulation, and developmental timing, the research aims to identify salt-tolerant genotypes and provide a physiological basis for their use in breeding programs.

**2. MATERIAL AND METHODS**

A field experiment was conducted during the *Kharif* seasons of 2021 and 2022 at the Agricultural Research Station (ARS), Gangavathi, to evaluate rice genotypes for salinity tolerance. The study assessed 36 rice genotypes, including four check varieties-two salt-tolerant (CSR22 and GANGAVATHI SONA) and two salt-sensitive (MTU1010 and BPT5204). Observations were recorded at 60 and 90 days after transplanting (DAT), and at harvest, focusing on morphological and phenological traits to evaluate salinity stress responses. Surface soil samples (0–15 cm) were collected, air-dried, and sieved (2 mm) for analysis. The soil pH was recorded at 8.13 (2021) and 8.17 (2022), while the electrical conductivity (ECe) was 10.90 dSm⁻¹ and 10.77 dSm⁻¹, respectively, indicating highly saline conditions. Plant height was measured from the base to the tip of the last sheath of the main shoot. Tillers per square meter were counted in a randomly selected area within the net plot. Leaf area was estimated by recording the number of leaves per plant and measuring the length and width of each leaf on the middle tiller. The Leaf Area Index (LAI) was calculated as the ratio of total leaf area to the land area occupied by a single plant. Dry matter production was determined by uprooting five plants from each plot (excluding border rows), separating leaves, stems, and panicles, and drying them at 65°C for 72 hours until a constant weight was achieved. The dry weights were expressed in grams per hill. The CGR is the rate of dry matter production per unit ground area per unit time. It is used for the estimation of production efficiency of crop. The CGR was calculated adopting the formula as suggested by Watson *et al*. (1952).

Days to 50% flowering were recorded as the number of days from transplanting until 50% of the plants in each plot initiated flowering. Physiological maturity was assessed as the number of days from transplanting until 50% of the panicles exhibited golden yellow grains with senescence of lower leaves. This study aimed to identify genotypes capable of maintaining growth and development under saline field conditions. By evaluating traits such as plant height, tillering, LAI, dry matter accumulation, and phenological development, the experiment sought to pinpoint salt-tolerant genotypes with promising adaptive traits for cultivation in salt-affected areas.

**3. RESULTS AND DISCUSSION**

Results on morphological parameters such as plant height, number of tillers, leaf area, leaf area index, crop growth rate and total dry matter differed significantly among the genotypes under salinity stress.

At 60 DAT, the pooled data showed significantly highest plant height in FL478 (95.92 cm), along with IET 28608 (95.38 cm), CSR10 (94.35cm) and GNV 1801 (93.37 cm) followed by CSR23 (93.10 cm), CSR 36 (92.96 cm) and GNV 1109 (90.87 cm) were on par with the top-performing genotypes These genotypes exhibited strong early growth, indicating that they can effectively tolerate saline stress. Significantly lowest plant height was found in GNV 1810 (75.01 cm), GNV 1804 (77.44 cm), and GNV 1802 (80.22 cm), indicating weaker growth under saline stress. At 90 DAT, pooled data recorded the significantly highest plant height was recorded in IET 28608 (112.21 cm) as compared to SIRI 1253 (109.64 cm), CSR 22 (107.23 cm) and FL478 (106.29 cm), followed by GNV 1806 (104.68 cm), GNV 1801 (104.61 cm), CSR23 (104.16 cm) indicating their sustained vegetative growth under saline conditions. Significantly lowest plant height was found in genotypes such as IET 29366 (85.07 cm) on par with PUSA44 (86.11 cm), MTU 1010 (87.09 cm), suggesting their limited growth potential under salinity. At harvest, pooled data indicated that the genotype IET 28608 (116.31 cm) exhibited the significantly highest plant height, along with SIRI 1253 (113.83 cm), FL478 (110.41 cm) and GNV 1109 (109.11 cm) followed by GNV 1801 (108.17 cm) CSR23 (107.70 cm), CSR10 (106.50 cm). These genotypes showed better adaptability to saline conditions, which might have contributed to improved biomass production, indicating their ability to sustain growth until maturity under salinity stress. The lowest plant heights at harvest were recorded in GNV 1804 (97.33 cm), GNV 1802 (101.89 cm) and GNV 1810 (102.40 cm), indicating their poor performance under saline conditions. FL478, IET 28608, SIRI 1253, CSR23, CSR10, and GNV 1801, exhibited enhanced growth under salinity stress, which could be attributed to their superior genetic adaptation mechanisms that allow better water uptake and cell elongation. These genotypes may possess efficient osmotic regulation systems or enhanced salt exclusion mechanisms that prevent cellular dehydration, a characteristic often linked to better overall stress toleranceUnder moderate salinity stress conditions, the plant height of rice genotypes is generally lower compared to traditional soil conditions due to osmotic stress, ion toxicity, nutrient imbalance, hormonal disruption and reduced energy allocation for growth. Similar findings were reported by Sultana *et al*. (2022) and Hasan *et al*. (2020).

At 60 DAT, pooled data showed significantly the highest tillers number was recorded in IET 28608 (34.24), as compared to CSR 23 (32.84), GNV 1109 (32.73), GNV 1806 (32.39) and. Followed by CSR10 (31.98), FL478 (31.91), CSR 36 (31.52) and GNV 1801 (31.14) were significantly on par with the top-performing genotypes, indicating their potential for salt tolerance. Conversely, the lowest tiller numbers were observed in IET 29354 (20.74), on par with BPT 5204 (21.25), and PUSA 44 (22.10), highlighting their susceptibility to salinity. At 90 DAT, pooled data indicated that the tiller count increased across genotypes, in which among CSR 36 (44.93) recorded a significantly highest number of tillers per plant, notably genotypes such as GNV 1801 (43.72), GNV 1806 (42.71), FL478 (41.71) IET 28608 (41.33). Notably, genotypes such as GNV 1806 (42.71), GNV 1109 (41.32), and SIRI 1253 (40.98) which were on par with each other showed significantly comparable performance to the top genotypes. But the lowest number of tillers per plant was recorded in the genotype IET 28606 (26.31), IET 29354 (26.55) and IET 27807 (27.52) recorded the fewest tillers, suggesting their limited tillering capacity under stress. At harvest, pooled data on number of tillers showed significant variation among the genotypes showed the tiller count remained high for CSR 36 (46.35), GNV 1801 (44.57), and GNV 1806 (43.53), exhibited significantly highest number of tillers per plant followed by FL478 (43.01), IET 28608 (42.62), and SIRI 1253 (41.76) performed on par with the highest performing genotypes. These results highlight CSR 36, GNV 1801, and FL478 as promising salt-tolerant genotypes. However, But the significantly lowest number of tillers per plant was recorded IET 29354 (26.93), MTU 1010 (28.47), and IET 28606 (27.03) under saline conditions. These results indicate that the genotype CSR 23, CSR 36, GNV 1806, FL478 consistently outperformed other genotypes in tiller number across all growth stages, while MTU 1010, IET 29354, IET 28606, PUSA 44 showed the lowest tiller counts, making it less favourable for tillering under salinity stress. Such variation among different genotypes was noticed by Hasan *et al*. (2020) under saline conditions. This indicates the inherent ability of the genotypes to respond under abiotic stress conditions.

At 60 DAT, pooled data revealed that the significantly highest leaf area was observed in SIRI 1253 (0.080) as compared to GNV 1109 (0.074), CSR23 (0.073), CSR 22 (0.072) and FL478 (0.071) their superior leaf expansion capacity under saline conditions, followed by IET 28608 (0.070), GNV 1806 (0.070), CSR36 (0.067), Which were on par with each other with the top genotypes, demonstrating moderate tolerance. Conversely, IET 28606 (0.049), IET 29354 (0.051) and MTU 1010 (0.054) recorded the lowest leaf area, reflecting their susceptibility to salt stress. By 90 DAT, pooled data on leaf area increased significantly, genotype GNV 1109 (0.098), along with GNV 1806 (0.097), GNV 1801 (0.096) and SIRI 1253 (0.095) exhibiting the highest leaf area. Which were on par with genotypes such as FL478 (0.091), IET 28608 – (0.091), CSR 36 (0.090), indicating their potential for long-term growth even under salt stress. But the significantly lowest leaf areas was observed in IET 28606 (0.063), GNV 1804 (0.065) IET 29366 (0.068) and MTU 1010 (0.071), this confirms their limited ability to adapt to salinity. During the harvest, the pooled data leaf area decreased across all genotypes. The highest leaf area was found in CSR 36 (0.077), as compared to IET 28608 (0.067), GNV 1109 (0.065), CSR10 (0.064) and GNV 1801 (0.063) maintained the highest values, showing improved leaf retention when exposed to prolonged salinity. Followed by genotypes such as CSR 22 (0.062), FL478 (0.061), SIRI 1253 (0.061), performed comparably to the highest-yielding genotypes, indicating their stability in maintaining leaf area. On the other hand, MTU 1010 (0.038), IET 29366 (0.040), and IET 29354 (0.040) recorded the lowest leaf area, indicating their vulnerability to salinity stress. Ali *et.al.* (2004) reported the reduction in leaf area, yield and yield components under saline conditions were also due to reduced growth as a result of decreased water uptake, toxicity of sodium and chloride in the shoot cell as well as reduced photosynthesis.

At 60 DAT, the pooled data of various rice genotypes showed that the highest LAI was recorded in SIRI 1253 (3.524), and GNV 1109 (3.246) followed by CSR23 (3.246), CSR 22 (3.201),FL478 (3.156) and CSR10 (3.134), which were on par with top performing genotypes. Other genotypes like, performed well, showing their moderate tolerance. In contrast, the lowest LAI recorded in the genotypes IET 28606 (2.186), on par with IET 29354 (2.264), PUSA44 (2.365) and MTU 1010 (2.442), indicating their sensitivity to salt levels in the environment. At 90 DAT, pooled data indicates that LAI significantly highest values were recorded in GNV 1109 (4.370), as compared to GNV 1806 (4.316), GNV 1801 (4.248) and SIRI 1253 (4.240) demonstrating superior leaf expansion, followed by genotypes such as FL478 (4.065), IET 28608 (4.041), CSR 22 (4.013), were exhibited statistically comparable LAI, reinforcing their salinity tolerance potential. But significantly lowest LAI values were found in IET 28606 (2.790), GNV 1804 (2.869), IET 29366 (3.029) and MTU 1010 (3.138), indicating their poor performance under salinity. At harvest, pooled data on Leaf Area Index (LAI) decreased across all genotypes. significantly the highest values were found in CSR 36 (3.417), along with GNV 1109 (2.889),CSR23 (2.849) and CSR 10 (2.831) The results suggest that the leaves maintained better quality even when exposed to prolonged salinity stress. Followed by genotypes such as GNV 1801 (2.790), CSR 22 (2.740), SIRI 1253 (2.690), FL478 (2.690). The performance of these genotypes was similar to the best ones. This shows that they remain stable even when faced with salinity stress. The significantly lowest LAI values were observed in MTU 1010 (1.694), IET 29366 (1.793), and GNV 1804 (1.843), demonstrating their susceptibility to salt-induced senescence. Decrease in LAI might have been due to decrease in leaf expansion in salinity stress condition and the results were in accordance with Hasanuzzaman *et.al*. (2009)

At 60 DAT, the pooled data from various rice genotypes indicated variation in crop growth rates (g/m²/day) across the genotypes. At this stage, significantly highest CGR values were recorded in GNV 1109 (29.17 g/m²/day), along with CSR22 (29.10 g/m²/day), IET 28608 (28.96), showing their significant growth in vegetation even under saline conditions. Followed by CSR23 (28.72 g/m²/day), GNV 1801 (28.12 g/m²/day), GNV 1806 (27.92 g/m²/day) FL478 (27.82 g/m²/day), SIRI 1253 (27.03 g/m²/day). Significantly lowest values of CGR were found in MTU 1010 (15.87 g/m²/day), on par with PUSA 44 (17.02 g/m²/day), IET 28606 (17.70 g/m²/day), and GNV 1804 (18.24 g/m²/day), indicating their inadequate early development in response to salt stress. At 90 DAT, pooled data of different rice genotypes showed a varied crop growth rate (g/m²/day) among the genotypes, significantly highest values were observed in GNV 1109 (59.85 g/m²/day), as compared to CSR 22 (57.08 g/m²/day), GNV 1801 (56.86 g/m²/day), IET 28608 (56.77 g/m²/day), exhibited the highest CGR, the plants adapt well and survive high salt levels during their peak growth stage. Followed by SIRI 1253 (56.68 g/m²/day), CSR23 (56.74 g/m²/day) and CSR 36 (55.51 g/m²/day), which were on par with top performing genotypes the growth rates were stable, indicating a partial tolerance to salinity stress. In contrast, MTU 1010 (31.79 g/m²/day), on par with PUSA 44 (34.00 g/m²/day) IET 28606 (35.50 g/m²/day), recorded the lowest CGR values, reflecting their susceptibility to salt stress. At harvest, the pooled data on crop growth rate, decreased significantly across all genotypes. The highest CGR values were maintained by GNV 653 (2.84 g/m²/day), along with GNV 1806 (2.26 g/m²/day), indicating their ability to sustain growth until maturity. Genotypes such as PUSA 44 (4.04 g/m²/day), IET 29354 (2.36 g/m²/day), and IET 29366 (2.05 g/m²/day) also demonstrated relatively higher CGR values. The lowest CGR values were observed in GNV 1801 (0.04 g/m²/day), GNV 1805 (0.25 g/m²/day), and GNV 1802 (0.24 g/m²/day), suggesting poor biomass accumulation at the final growth stage. Intermediate genotypes such as CSR 22 (1.43 g/m²/day), FL478 (1.37 g/m²/day), and CSR23 (1.38 g/m²/day) maintained reasonable growth towards harvest, reflecting moderate resilience under saline conditions. Overall, the study indicates that GNV 1109, CSR 23, and SIRI 1253 exhibited superior growth across all stages, while MTU 1010, IET 28606, and GNV 1804 showed poor performance under salinity stress. Such variation among different genotypes was noticed by Hasan *et al*. (2020) under saline conditions. This indicates the inherent ability of the genotypes to respond under abiotic stress conditions

At 60 (DAT), pooled data on leaf dry matter was significantly highest observed in CSR 36 (13.65 g/hill), significantly superior to all other genotypes except CSR 10 (12.83 g/hill), IET 28608 (12.77 g/hill), and GNV 1801 (12.76 g/hill). Followed by GNV 1806 (12.65 g/hill), CSR23 (12.27 g/hill), GNV 1109 (12.13 g/hill) and FL478 (11.96 g/hill). These genotypes exhibited superior early-stage growth under salinity stress. Similarly, significantly lowest leaf dry matter recorded in genotypes such as IET 29354 (6.95 g/hill), PUSA 44 (7.42 g/hill), MTU 1010 (7.43 g/hill) recorded the lowest leaf dry matter at this stage, indicating poor early vegetative growth under stress. At 90 DAT, pooled data on leaf dry matter was significantly highest recorded in IET 28608 (27.31 g/hill) which was significantly superior to other genotypes recorded the highest leaf dry matter, followed by GNV 1109 (27.10 g/hill), and GNV 1801 (26.46 g/hill) and CSR 23 (26.39 g/hill), These genotypes retained better biomass accumulation during the reproductive phase, but the significantly lowest leaf dry matter, recorded in MTU 1010 (13.76 g/hill) and PUSA 44 (14.36 g/hill) continued to show reduced biomass production, indicating sustained stress sensitivity. At harvest, pooled data on leaf dry matter was significantly highest observed in IET 28608 (22.55 g/hill) showed the maximum leaf dry matter, followed by GNV 1109 (22.49 g/hill), CSR 23 (22.27 g/hill) and GNV1801 (21.67g/hill). These genotypes maintained high biomass throughout the crop growth period, suggesting resilience to salinity stress. Meanwhile, the significantly lowest leaf dry matter found in MTU 1010 (10.86 g/hill), PUSA 44 (11.45 g/hill), and IET 28606 (13.24 g/hill) were among the lowest in leaf dry matter at harvest, further confirming their vulnerability under saline conditions. Similar findings were reported by uzzaman *et. al*. (2015). The entries viz, IET 28608, CSR 36, CSR 23, GNV 1109, and GNV 1801 recorded significantly higher dry matter production compared to checks. Higher dry matter production is directly related to higher number of leaves, leaf size, photosynthetic rate, chlorophyll content and also the translocation of the photosynthates towards the sink.

At 60 DAT, the pooled data on stem dry matter was significantly highest observed in SIRI 1253(16.51 g/hill), significantly superior to all other genotypes, it was followed by FL478 (16.38 g/hill), CSR 10 (16.37 g/hill) and CSR 36 (15.75 g/hill). On the other hand, the significantly moderate stem dry matter recorded in IET 28608 (15.49 g/hill), GNV 1801(15.48 g/hill). But the significantly lowest stem dry matter was recorded in IET 29354 (8.52 g/hill), followed by IET 28606 (9.06 g/hill), PUSA 44 (9.10 g/hill) and IET 29366 (9.21 g/hill). These differences indicate that the genotypes exhibit considerable variability in stem dry matter production at early growth stages. At 90 DAT, the pooled data on stem dry matter was significantly highest recorded in CSR 22 (40.86 g/hill), along with FL478 (40.35 g/hill), CSR 36 (40.03 g/hill), followed by SIRI 1253 (39.85 g/hill), GNV 1806 (39.47 g/hill), IET 28608 (38.07 g/hill), all of which were significantly higher than other genotypes. But the significantly lowest stem dry matter was recorded in IET 28606 (22.08 g/hill) MTU 1010 (23.68 g/hill), PUSA 44 (23.76g/hill). The range in stem dry matter values at this stage suggests substantial genotype-by-salinity interaction, influencing the biomass accumulation at the mid vegetative stages.At harvest, the pooled data significantly highest stem dry matter was recorded in CSR22 (42.95 g/hill), as compared to FL478 (42.78 g/hill) and CSR 10 (41.10 g/hill), followed by GNV 1806 (42.19 g/hill), SIRI 1253 (41.90 g/hill), GNV 1801 (40.38 g/hill) and IET 28608 (40.20 g/hill) performed on par compared to top genotypes all of which showed higher biomass accumulation by harvest. But the significantly lowest stem dry matter was found in IET 28606 ((24.53 g/hill) IET 28606 (24.53 g/hill), and IET 29354 (26.35 g/hill). These findings further demonstrate the genotypic differences in biomass production under varying salinity levels, with some genotypes exhibiting higher resilience to salinity stress over the entire growth period. Salinity stress poses a significant challenge to rice cultivation by impairing physiological functions, reducing nutrient uptake, and hindering plant growth. Among the various plant parts, the stem plays a crucial role in supporting overall growth and contributing to the plant’s biomass accumulation, which directly influences yield. In this study, the variation in stem dry matter (g/hill) under salinity stress highlights the differential response of rice genotypes to saline conditions. These findings are coinciding with the findings of Ndayiragije *et.al*.(2007).

At 60 DAT, pooled data on panicle dry matter was recorded the significantly highest in CSR23 (9.26 g/hill) which was significantly superior over all the genotypes, followed by CSR 36 (9.23 g/hill), GNV 1801 (9.18 g/hill) and GNV 1801 (9.18 g/hill), both showing the highest values for panicle dry matter across all genotypes. On the other hand, the significantly lowest panicle dry matter values were observed in IET 28606 (5.87 g/hill) which was on par with GNV 1804 (6.69 g/hill) and GNV 1805 (6.88 g/hill), demonstrating a significant reduction in dry matter compared to the highest-performing genotypes. At 90 DAT, pooled data on panicle dry matter was reported the significantly highest in in CSR23 (10.76 g/hill), which was significantly superior to other genotypes, followed by SIRI 1253 (10.75 g/hill), GNV1801 (10.72 g/hill), exhibited the highest panicle dry matter values, suggesting these genotypes performed optimally under salinity stress during this stage. Conversely, the significantly lowest panicle dry matter values were reported in IET 28606 (7.89 g/hill), on par with IET 29366 (8.29 g/hill), IET 27807 (8.40 g/hill) and GNV 1805 (8.43 g/hill) all of which displayed suboptimal performance during the 90-day growth phase. At harvest, pooled data on panicle dry matter was recorded the significantly highest in GNV 1109 (13.87 g/hill), along with GNV1801 (13.72 g/hill), IET 28608 (13.48 g/hill), CSR23 13.40 g/hill) emerged as the highest-performing genotypes in terms of panicle dry matter, exhibiting substantial growth despite the salinity conditions followed by CSR 22 (13.29 g/hill), CSR 36 (13.24 g/hill), FL478 (13.09 g/hill), on par with top performing genotypes. On the other hand, IET 28606 (10.53 g/hill), on par with IET 29366 (10.93 g/hill), MTU 1010 (11.06 g/hill), GNV 1805 (11.07 g/hill), represented the lowest values at harvest, indicating that these genotypes experienced a more pronounced reduction in growth at maturity under salinity stress. The pooled data indicates a significant effect of salinity on panicle dry matter accumulation, with certain genotypes showing better tolerance to saline stress. The variability observed in the panicle dry matter among the genotypes can be attributed to differences in their genetic makeup, which influences their physiological processes like nutrient uptake, water use efficiency, and stress tolerance mechanisms. Some genotypes, such as, CSR23, GNV1801, IET 28608, CSR 36, and GNV 1109, appear to have a better ability to accumulate dry matter under salinity stress, suggesting that they may possess genes related to salt tolerance and efficient resource utilization. our findings are in accordance with the reported by Oladosu *et.al*. (2018)

At 60 DAT, the pooled data on total dry matter was recorded significantly highest in CSR 36 (38.63 g/hill), along with CSR 10 (37.72 g/hill), GNV 1806 (37.71 g/hill), followed by GNV 1801 (37.42 g/hill), IET 28608 (37.40 g/hill), CSR 22 (37.37 g/hill), GNV 1807 (37.28 g/hill), These genotypes exhibited the best growth performance under saline conditions at this stage. On the other hand, the significantly lowest total dry matter was observed in IET 29354 (22.19 g/hill) on par with IET 28606 (23.14 g/hill) IET 29366 (23.26 g/hill), GNV 1804 (23.32 g/hill) indicating a poor response to salinity in terms of biomass accumulation at 60 DAT. These genotypes were significantly lower than the top-performing ones. At 90 DAT, the pooled data on total dry matter was recorded significantly highest in GNV 1109 (77.24 g/hill) along with CSR 36 (76.11 g/hill), CSR 22 (75.90 g/hill), GNV 1801 (75.80 g/hill), followed by IET 28608 (75.72 g/hill), CSR23 (75.58 g/hill), SIRI 1253 (74.90 g/hill), CSR 10 (74.92 g/hill), recording the highest total dry matter. These genotypes consistently performed well, showing their resilience to salinity stress. The significantly lowest dry matter accumulation at 90 DAT was noted in MTU 1010 (45.86 g/hill), on par with PUSA 44 (47.01 g/hill) IET 28606 (47.10 g/hill) and GNV 1804 (49.20 g/hill), which remained at the lower end of the spectrum. These values were significantly lower than those of the genotypes with the highest dry matter. At harvest, pooled data on total dry matter was showed significantly highest in GNV 1109 (77.00 g/hill), which was statistically similar to CSR 22 (76.92 g/hill), CSR 23 (76.51 g/hill), IET 28608 (76.23 g/hill), CSR 36 (76.21 g/hill), followed by GNV 1801 (75.77 g/hill), GNV 1806 (75.63 g/hill), CSR 10 (75.50 g/hill) indicating robust growth throughout the cropping period under saline conditions. In contrast, MTU 1010 (47.47 g/hill), IET 28606 (48.30 g/hill) and PUSA 44 (49.74 g/hill) had the lowest total dry matter, exhibiting poor growth, which could be attributed to their lower salinity tolerance.

This is consistent with the findings of Zayed *et al.* (2011), who reported that salinity stress reduces the ability of rice plants to synthesize and accumulate dry matter, particularly in less tolerant varieties.

In the year 2021, the rice genotypes exhibited a range of flowering times, with the earliest flowering genotype being IET 29354 (88.00 days) and the latest flowering genotype being GNV 1804 (97.00 days). The mean days to 50% flowering across all genotypes in 2021 was 92.47 days. The genotype IET 28608 flowered the earliest among the high-performing genotypes, showing 96.50 days, while IET 29354 took the least time to reach 50% flowering. In the year 2022, the pattern of flowering remained consistent, with IET 28608 flowering the earliest (90.00 days) and FL478 flowering the latest (97.00 days). The mean flowering time for 2022 was 92.26 days, which is almost identical to that observed in 2021. IET 28608 and IET 27807 were among the genotypes that exhibited relatively early flowering under the salinity stress, indicating possible tolerance to salinity-induced delays in flowering. On the other hand, GNV 1812 and GNV 1801 exhibited slightly later flowering times, though the difference was not statistically significant. The pooled data, which combines the observations from both years, revealed a mean of 92.37 days for 50% flowering. The flowering times of the genotypes ranged from 88.00 days in IET 29354 to 97.00 days in GNV 1804, with a narrow variation overall. This suggests that while some genotypes may flower slightly earlier or later across years, the overall impact of salinity on the flowering time was minimal for most genotypes. no significant difference between the genotypes for days to 50% flowering, suggesting that salinity did not cause major delays in flowering across the tested genotypes. Crop productivity is impacted by salinity because it interferes with nitrogen uptake and reduces the growth and ceases the reproduction due to increased Na+ concentration. similar findings were reported by Pranaya *et. al*. (2024)

Pooled data on days to physiological maturity was recorded in genotype IET 28608 (115.00 days), followed by IET 27823 (115.75 days). These genotypes were among the slowest maturing under saline conditions, which suggests that they might have a longer growth duration under stress, potentially due to their genetic makeup or better tolerance to the saline environment. On the other hand, CSR 23 (97.25 days) had the shortest duration to reach physiological maturity, indicating a relatively quicker maturation under salinity stress. This could be a result of the genotype’s inherent early maturing trait or its adaptive mechanism to salinity, potentially reducing its vegetative growth phase to minimize stress exposure. Other genotypes such as IET 27077 (110.75 days), IET 29356 (110.25 days), and CSR 36 (109.75 days) exhibited intermediate maturity durations, suggesting their moderate adaptation to salinity stress. Genotypes like IET 29361 (113.25 days), IET 29364 (108.75 days), and GNV 1812 (105.75 days) also showed similar maturity patterns, implying that these genotypes can tolerate salinity stress while maintaining relatively stable growth rates. Similar findings were reported by uzzaman *et al*. (2015)

**Table 1. Influence of salinity on plant height (cm), Number of tillers (hill-1), Leaf area (m2) of different rice genotypes during different growth stages**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl.**  **No.** | **Genotypes** | **Plant height (cm)** | | | **Number of tillers (hill-1)** | | | **Leaf area (m2)** | | |
| **Days after transplanting (DAT)** | | | | | | | | |
| **Pooled** | | | **Pooled** | | | **Pooled** | | |
| **60** | **90** | **At harvest** | **60** | **90** | **At harvest** | **60** | **90** | **At harvest** |
| 1 | **IET 28608** | 95.38 | 112.21 | 116.31 | 34.24 | 41.33 | 42.62 | 0.070 | 0.091 | 0.067 |
| 2 | **IET 27077** | 91.43 | 92.76 | 96.01 | 27.08 | 39.99 | 41.45 | 0.067 | 0.075 | 0.060 |
| 3 | **IET 27823** | 87.30 | 88.68 | 95.95 | 24.93 | 34.15 | 35.16 | 0.058 | 0.086 | 0.045 |
| 4 | **IET 28606** | 81.86 | 88.88 | 90.40 | 28.01 | 26.31 | 27.03 | 0.049 | 0.063 | 0.041 |
| **5** | **CSR 36** | 92.96 | 103.09 | 106.15 | 31.52 | 44.93 | 46.35 | 0.067 | 0.090 | 0.077 |
| 6 | **IET 27807** | 84.75 | 90.83 | 94.34 | 26.36 | 27.52 | 28.29 | 0.059 | 0.076 | 0.055 |
| 7 | **IET 29356** | 85.07 | 92.41 | 95.35 | 29.29 | 32.75 | 33.71 | 0.060 | 0.080 | 0.059 |
| 8 | **IET 29365** | 84.80 | 92.08 | 94.82 | 29.91 | 27.16 | 27.92 | 0.059 | 0.073 | 0.056 |
| 9 | **CSR23** | 93.10 | 104.16 | 107.70 | 32.84 | 37.43 | 38.56 | 0.073 | 0.087 | 0.064 |
| 10 | **IET 29354** | 84.01 | 96.58 | 101.19 | 20.74 | 26.55 | 26.93 | 0.051 | 0.072 | 0.040 |
| 11 | **IET 29360** | 88.44 | 96.32 | 98.99 | 24.33 | 37.00 | 38.12 | 0.054 | 0.077 | 0.043 |
| 12 | **CSR10** | 94.35 | 102.49 | 106.50 | 31.98 | 38.33 | 39.50 | 0.070 | 0.088 | 0.064 |
| 13 | **IET 29361** | 86.61 | 96.75 | 100.60 | 28.43 | 34.38 | 35.40 | 0.062 | 0.084 | 0.052 |
| 14 | **IET 29364** | 88.64 | 92.77 | 95.96 | 30.18 | 32.43 | 33.38 | 0.060 | 0.085 | 0.048 |
| 15 | **FL478** | 95.92 | 106.29 | 110.41 | 31.91 | 41.71 | 43.01 | 0.071 | 0.091 | 0.061 |
| 16 | **IET 29366** | 87.27 | 85.07 | 88.50 | 23.35 | 27.96 | 28.74 | 0.055 | 0.068 | 0.040 |
| 17 | **IET 29358** | 84.75 | 95.27 | 98.62 | 29.12 | 33.21 | 34.19 | 0.065 | 0.079 | 0.053 |
| 18 | **PUSA44** | 83.03 | 86.11 | 89.08 | 22.10 | 28.63 | 29.07 | 0.054 | 0.072 | 0.046 |
| 19 | **IET 29353** | 84.69 | 92.17 | 95.53 | 26.71 | 31.16 | 32.07 | 0.059 | 0.083 | 0.048 |
| 20 | **SIRI 1253** | 91.09 | 109.64 | 113.83 | 31.13 | 40.98 | 41.76 | 0.080 | 0.095 | 0.061 |
| 21 | **GNV 1806** | 91.18 | 104.68 | 112.81 | 32.39 | 42.71 | 43.53 | 0.070 | 0.097 | 0.064 |
| 22 | **GNV 1807** | 80.97 | 91.44 | 96.13 | 26.76 | 38.70 | 39.41 | 0.062 | 0.082 | 0.053 |
| 23 | **GNV 1801** | 93.37 | 104.61 | 108.17 | 31.14 | 43.72 | 44.57 | 0.070 | 0.096 | 0.063 |
| 24 | **GNV 1812** | 84.34 | 89.27 | 94.48 | 30.17 | 35.74 | 36.38 | 0.059 | 0.086 | 0.050 |
| 25 | **GNV 1803** | 80.46 | 93.57 | 97.41 | 25.88 | 34.52 | 35.13 | 0.061 | 0.085 | 0.054 |
| 26 | **GNV 1802** | 80.22 | 97.59 | 101.89 | 28.37 | 32.22 | 32.77 | 0.064 | 0.080 | 0.049 |
| 27 | **GNV 1109** | 90.87 | 105.05 | 109.11 | 32.73 | 41.32 | 42.11 | 0.074 | 0.098 | 0.065 |
| 28 | **GNV 1805** | 82.99 | 92.85 | 96.14 | 28.12 | 28.85 | 29.30 | 0.062 | 0.078 | 0.047 |
| 29 | **GNV 1804** | 77.44 | 93.00 | 97.33 | 27.68 | 34.28 | 34.88 | 0.056 | 0.065 | 0.041 |
| 30 | **GNV 1808** | 81.10 | 101.56 | 106.33 | 28.84 | 33.40 | 33.98 | 0.062 | 0.089 | 0.052 |
| 31 | **GNV 1810** | 75.01 | 93.98 | 102.40 | 29.80 | 31.41 | 31.94 | 0.063 | 0.077 | 0.053 |
| 32 | **GNV 653** | 89.23 | 97.67 | 101.48 | 29.64 | 30.02 | 30.51 | 0.061 | 0.087 | 0.055 |
| 33 | **MTU 1010** | 80.32 | 87.09 | 90.98 | 27.48 | 27.70 | 28.47 | 0.054 | 0.071 | 0.038 |
| 34 | **BPT 5204** | 86.22 | 99.74 | 105.20 | 21.25 | 40.16 | 41.41 | 0.062 | 0.079 | 0.057 |
| 35 | **GANGAVATHI SONA** | 84.95 | 94.87 | 100.10 | 26.31 | 33.50 | 34.08 | 0.053 | 0.085 | 0.049 |
| 36 | **CSR 22** | 87.98 | 107.23 | 110.94 | 28.09 | 34.11 | 35.12 | 0.072 | 0.090 | 0.062 |
|  | **Mean** | **86.45** | **96.63** | **100.75** | **28.30** | **34.62** | **35.47** | **0.062** | **0.082** | **0.054** |
|  | **S.Em (±)** | **3.32** | **4.36** | **3.51** | **0.93** | **1.76** | **2.07** | **0.002** | **0.003** | **0.002** |
|  | **C.D.(p=0.05)** | **10.07** | **13.21** | **10.64** | **2.79** | **5.29** | **6.20** | **0.007** | **0.010** | **0.007** |

**Table 2. Influence of salinity on leaf area index, crop growth rate (g/m2/day), leaf dry matter, (g/hill) of different rice genotypes during different growth stages**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl.**  **No.** | **Genotypes** | **Leaf Area Index** | | | **Crop growth rate (g/m2/day-1)** | | | **Leaf dry matter (g/hill)** | | |
| **Days after transplanting (DAT)** | | | | | | | | |
| **Pooled** | | | **Pooled** | | | **Pooled** | | |
| **60** | **90** | **At harvest** | **60** | **90** | **At harvest** | **60** | **90** | **At harvest** |
| 1 | **IET 28608** | 3.112 | 4.041 | 2.992 | 28.96 | 56.77 | 0.75 | 12.77 | 27.31 | 22.55 |
| 2 | **IET 27077** | 2.989 | 3.347 | 2.678 | 19.29 | 42.15 | 1.11 | 11.33 | 22.79 | 18.07 |
| 3 | **IET 27823** | 2.587 | 3.826 | 1.993 | 18.06 | 38.35 | 0.90 | 10.12 | 20.58 | 16.51 |
| 4 | **IET 28606** | 2.186 | 2.790 | 1.843 | 17.70 | 35.50 | 1.77 | 8.21 | 17.13 | 13.24 |
| **5** | **CSR 36** | 2.967 | 3.985 | 3.417 | 27.49 | 55.51 | 1.42 | 13.65 | 25.48 | 20.66 |
| 6 | **IET 27807** | 2.665 | 3.391 | 2.423 | 21.55 | 43.37 | 1.76 | 9.56 | 21.29 | 17.38 |
| 7 | **IET 29356** | 2.665 | 3.559 | 2.630 | 21.71 | 45.55 | 1.04 | 10.66 | 23.39 | 19.36 |
| 8 | **IET 29365** | 2.643 | 3.256 | 2.499 | 23.96 | 48.74 | 1.22 | 9.11 | 22.70 | 18.70 |
| 9 | **CSR23** | 3.246 | 3.861 | 2.849 | 28.72 | 56.74 | 1.38 | 12.27 | 26.39 | 22.27 |
| 10 | **IET 29354** | 2.264 | 3.180 | 1.793 | 19.12 | 40.17 | 2.36 | 6.95 | 16.44 | 13.23 |
| 11 | **IET 29360** | 2.398 | 3.407 | 1.893 | 25.59 | 50.47 | 0.89 | 9.91 | 22.70 | 18.57 |
| 12 | **CSR10** | 3.134 | 3.905 | 2.831 | 28.04 | 55.10 | 0.87 | 12.83 | 25.98 | 21.15 |
| 13 | **IET 29361** | 2.766 | 3.746 | 2.291 | 20.61 | 43.74 | 0.99 | 10.96 | 22.70 | 18.20 |
| 14 | **IET 29364** | 2.688 | 3.758 | 2.142 | 23.53 | 46.46 | 0.67 | 9.09 | 21.56 | 17.44 |
| 15 | **FL478** | 3.156 | 4.065 | 2.690 | 27.82 | 53.68 | 1.37 | 11.96 | 22.70 | 18.55 |
| 16 | **IET 29366** | 2.465 | 3.029 | 1.793 | 21.44 | 40.92 | 2.05 | 7.45 | 16.40 | 13.30 |
| 17 | **IET 29358** | 2.900 | 3.515 | 2.341 | 20.21 | 43.42 | 0.58 | 10.56 | 22.39 | 18.23 |
| 18 | **PUSA44** | 2.365 | 3.188 | 2.042 | 17.02 | 34.00 | 4.04 | 7.42 | 14.36 | 11.45 |
| 19 | **IET 29353** | 2.621 | 3.684 | 2.142 | 24.60 | 46.61 | 1.29 | 9.93 | 20.43 | 16.78 |
| 20 | **SIRI 1253** | 3.524 | 4.240 | 2.690 | 27.03 | 56.68 | 0.65 | 11.04 | 24.30 | 20.05 |
| 21 | **GNV 1806** | 3.145 | 4.316 | 2.839 | 27.92 | 53.93 | 2.26 | 12.65 | 24.07 | 20.23 |
| 22 | **GNV 1807** | 2.744 | 3.666 | 2.341 | 22.47 | 48.03 | 0.28 | 10.42 | 24.46 | 20.46 |
| 23 | **GNV 1801** | 3.112 | 4.248 | 2.790 | 28.12 | 56.86 | 0.04 | 12.76 | 26.46 | 21.67 |
| 24 | **GNV 1812** | 2.632 | 3.808 | 2.242 | 23.15 | 49.19 | 0.38 | 9.07 | 22.76 | 18.30 |
| 25 | **GNV 1803** | 2.710 | 3.766 | 2.391 | 23.95 | 51.00 | 0.49 | 9.67 | 24.97 | 20.83 |
| 26 | **GNV 1802** | 2.866 | 3.539 | 2.192 | 24.65 | 49.91 | 0.24 | 9.29 | 20.73 | 16.27 |
| 27 | **GNV 1109** | 3.246 | 4.370 | 2.889 | 29.17 | 59.85 | 0.36 | 12.13 | 27.10 | 22.49 |
| 28 | **GNV 1805** | 2.744 | 3.487 | 2.092 | 21.09 | 44.93 | 0.25 | 9.61 | 20.73 | 16.36 |
| 29 | **GNV 1804** | 2.476 | 2.869 | 1.843 | 18.24 | 38.32 | 2.04 | 7.45 | 16.44 | 13.10 |
| 30 | **GNV 1808** | 2.777 | 3.937 | 2.291 | 22.69 | 49.62 | 0.80 | 9.00 | 22.85 | 18.53 |
| 31 | **GNV 1810** | 2.811 | 3.431 | 2.341 | 22.15 | 45.15 | 2.18 | 9.13 | 18.82 | 15.41 |
| 32 | **GNV 653** | 2.732 | 3.885 | 2.441 | 23.33 | 47.81 | 2.84 | 10.34 | 24.07 | 20.88 |
| 33 | **MTU 1010** | 2.442 | 3.138 | 1.694 | 15.87 | 31.79 | 2.38 | 7.43 | 13.76 | 10.86 |
| 34 | **BPT 5204** | 2.755 | 3.507 | 2.540 | 24.04 | 48.44 | 1.43 | 10.27 | 23.50 | 19.79 |
| 35 | **GANGAVATHI SONA** | 2.376 | 3.758 | 2.192 | 25.60 | 47.42 | 1.17 | 9.68 | 21.62 | 17.36 |
| 36 | **CSR 22** | 3.201 | 4.013 | 2.740 | 29.10 | 57.08 | 1.50 | 12.57 | 24.39 | 20.68 |
|  | **Mean** | **2.781** | **3.653** | **2.384** | **23.44** | **47.59** | **1.21** | **10.20** | **22.05** | **18.02** |
|  | **S.Em (±)** | **0.122** | **0.128** | **0.104** | **0.73** | **1.66** | **0.09** | **0.36** | **0.87** | **0.53** |
|  | **C.D.(p=0.05)** | **0.371** | **0.389** | **0.316** | **2.19** | **4.99** | **0.29** | **1.07** | **2.59** | **1.59** |

**Table 3. Influence of salinity on stem dry matter (g/hill), panicles dry matter (g/hill), total dry matter (g/hill) of different rice genotypes during different growth stages**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl.**  **No.** | **Genotypes** | **Stem dry matter (g/hill)** | | | **Panicles dry matter (g/hill)** | | | **Total dry matter (g/hill)** | | |
| **Days after transplanting (DAT)** | | | | | | | | |
| **Pooled** | | | **Pooled** | | | **Pooled** | | |
| **60** | **90** | **At harvest** | **60** | **90** | **At harvest** | **60** | **90** | **At harvest** |
| 1 | **IET 28608** | 15.49 | 38.07 | 40.20 | 9.14 | 10.34 | 13.48 | 37.40 | 75.72 | 76.23 |
| 2 | **IET 27077** | 13.20 | 29.39 | 31.22 | 8.12 | 8.92 | 12.56 | 32.65 | 61.10 | 61.85 |
| 3 | **IET 27823** | 11.51 | 25.38 | 27.41 | 7.80 | 9.37 | 12.01 | 29.43 | 55.33 | 55.93 |
| 4 | **IET 28606** | 9.06 | 22.08 | 24.53 | 5.87 | 7.89 | 10.53 | 23.14 | 47.10 | 48.30 |
| **5** | **CSR 36** | 15.75 | 40.03 | 42.31 | 9.23 | 10.60 | 13.24 | 38.63 | 76.11 | 76.21 |
| 6 | **IET 27807** | 12.20 | 28.46 | 30.92 | 7.12 | 8.40 | 11.04 | 28.88 | 58.15 | 59.34 |
| 7 | **IET 29356** | 13.05 | 29.56 | 31.65 | 8.64 | 10.25 | 12.89 | 32.97 | 63.71 | 64.41 |
| 8 | **IET 29365** | 11.22 | 29.08 | 31.26 | 8.17 | 9.62 | 12.26 | 28.50 | 61.40 | 62.22 |
| 9 | **CSR23** | 16.37 | 38.94 | 41.35 | 9.26 | 10.76 | 13.40 | 37.28 | 75.58 | 76.51 |
| 10 | **IET 29354** | 8.52 | 24.18 | 26.35 | 6.72 | 8.69 | 11.33 | 22.19 | 49.31 | 50.91 |
| 11 | **IET 29360** | 11.55 | 31.08 | 33.16 | 7.47 | 9.23 | 11.87 | 28.93 | 63.01 | 63.60 |
| 12 | **CSR10** | 16.37 | 39.33 | 41.10 | 8.52 | 9.61 | 13.25 | 37.72 | 74.92 | 75.50 |
| 13 | **IET 29361** | 13.13 | 29.21 | 31.73 | 7.55 | 9.26 | 11.90 | 31.64 | 61.17 | 61.83 |
| 14 | **IET 29364** | 12.43 | 30.26 | 32.19 | 8.34 | 9.40 | 12.04 | 29.86 | 61.22 | 61.67 |
| 15 | **FL478** | 16.38 | 40.35 | 42.78 | 8.92 | 10.45 | 13.09 | 37.26 | 73.50 | 74.42 |
| 16 | **IET 29366** | 9.21 | 26.20 | 28.05 | 6.60 | 8.29 | 10.93 | 23.26 | 50.89 | 52.28 |
| 17 | **IET 29358** | 13.23 | 29.37 | 31.29 | 8.11 | 9.44 | 12.08 | 31.90 | 61.20 | 61.60 |
| 18 | **PUSA44** | 9.10 | 23.76 | 26.76 | 7.54 | 8.89 | 11.53 | 24.06 | 47.01 | 49.74 |
| 19 | **IET 29353** | 12.16 | 32.07 | 33.95 | 7.43 | 8.48 | 11.12 | 29.52 | 60.98 | 61.85 |
| 20 | **SIRI 1253** | 16.51 | 39.85 | 41.90 | 9.09 | 10.75 | 13.39 | 36.64 | 74.90 | 75.34 |
| 21 | **GNV 1806** | 15.89 | 39.47 | 42.19 | 9.17 | 10.57 | 13.21 | 37.71 | 74.11 | 75.63 |
| 22 | **GNV 1807** | 13.07 | 30.10 | 31.64 | 8.89 | 10.25 | 12.89 | 32.38 | 64.81 | 64.99 |
| 23 | **GNV 1801** | 15.48 | 38.62 | 40.38 | 9.18 | 10.72 | 13.72 | 37.42 | 75.80 | 75.77 |
| 24 | **GNV 1812** | 11.91 | 29.97 | 32.04 | 7.84 | 9.31 | 11.95 | 28.82 | 62.04 | 62.29 |
| 25 | **GNV 1803** | 12.13 | 29.50 | 31.33 | 7.57 | 9.33 | 11.97 | 29.37 | 63.80 | 64.13 |
| 26 | **GNV 1802** | 11.92 | 32.72 | 34.70 | 8.58 | 10.03 | 12.67 | 29.79 | 63.48 | 63.64 |
| 27 | **GNV 1109** | 15.74 | 39.55 | 40.64 | 8.98 | 10.59 | 13.87 | 36.85 | 77.24 | 77.00 |
| 28 | **GNV 1805** | 11.83 | 29.49 | 31.39 | 6.88 | 8.43 | 11.07 | 28.32 | 58.65 | 58.82 |
| 29 | **GNV 1804** | 9.18 | 24.27 | 26.35 | 6.69 | 8.49 | 11.13 | 23.32 | 49.20 | 50.58 |
| 30 | **GNV 1808** | 12.16 | 29.80 | 32.01 | 7.40 | 9.41 | 12.05 | 28.56 | 62.06 | 62.59 |
| 31 | **GNV 1810** | 11.60 | 30.72 | 32.96 | 7.55 | 9.23 | 11.87 | 28.28 | 58.77 | 60.24 |
| 32 | **GNV 653** | 13.21 | 29.94 | 32.40 | 8.34 | 10.16 | 12.80 | 31.89 | 64.17 | 66.08 |
| 33 | **MTU 1010** | 10.18 | 23.68 | 25.55 | 6.78 | 8.42 | 11.06 | 24.39 | 45.86 | 47.47 |
| 34 | **BPT 5204** | 13.62 | 31.50 | 33.54 | 8.44 | 10.03 | 12.67 | 32.33 | 65.03 | 66.00 |
| 35 | **GANGAVATHI SONA** | 12.53 | 31.07 | 33.48 | 7.37 | 8.90 | 11.54 | 29.58 | 61.59 | 62.38 |
| 36 | **CSR 22** | 15.88 | 40.86 | 42.95 | 8.92 | 10.65 | 13.29 | 37.37 | 75.90 | 76.92 |
|  | **Mean** | **12.85** | **31.61** | **33.71** | **8.00** | **9.53** | **12.27** | **31.06** | **63.19** | **64.01** |
|  | **S.Em (±)** | **0.52** | **0.92** | **1.02** | **0.27** | **0.26** | **0.42** | **1.30** | **2.35** | **2.09** |
|  | **C.D.(p=0.05)** | **1.55** | **2.74** | **3.07** | **0.80** | **0.78** | **1.26** | **3.90** | **7.04** | **6.28** |

**Table 4. Influence of salinity on days to 50 % flowering and days to physiological maturity of different rice genotypes**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl.**  **No.** | **Genotypes** | **Days to 50 % flowering** | | | **Days to physiological maturity** | | |
| **2021** | **2022** | **Pooled** | **2021** | **2022** | **Pooled** |
| 1 | **IET 28608** | 96.50 | 90.00 | 93.25 | 116.50 | 113.50 | 115.00 |
| 2 | **IET 27077** | 90.00 | 91.50 | 90.75 | 115.50 | 106.00 | 110.75 |
| 3 | **IET 27823** | 91.50 | 92.00 | 91.75 | 113.50 | 118.00 | 115.75 |
| 4 | **IET 28606** | 91.50 | 91.00 | 91.25 | 106.00 | 114.00 | 110.00 |
| 5 | **CSR 36** | 91.00 | 90.50 | 90.75 | 109.50 | 110.00 | 109.75 |
| 6 | **IET 27807** | 95.50 | 93.50 | 94.50 | 113.50 | 113.50 | 113.50 |
| 7 | **IET 29356** | 92.50 | 94.00 | 93.25 | 113.50 | 107.00 | 110.25 |
| 8 | **IET 29365** | 94.00 | 92.00 | 93.00 | 106.00 | 114.00 | 110.00 |
| 9 | **CSR23** | 92.00 | 93.00 | 92.50 | 88.50 | 106.00 | 97.25 |
| 10 | **IET 29354** | 88.00 | 90.00 | 89.00 | 106.00 | 114.00 | 110.00 |
| 11 | **IET 29360** | 90.00 | 90.50 | 90.25 | 112.50 | 117.00 | 114.75 |
| 12 | **CSR10** | 91.50 | 91.00 | 91.25 | 88.50 | 109.50 | 99.00 |
| 13 | **IET 29361** | 91.00 | 90.00 | 90.50 | 113.50 | 113.00 | 113.25 |
| 14 | **IET 29364** | 91.50 | 92.00 | 91.75 | 109.50 | 108.00 | 108.75 |
| 15 | **FL478** | 91.50 | 97.00 | 94.25 | 108.00 | 112.00 | 110.00 |
| 16 | **IET 29366** | 91.00 | 92.00 | 91.50 | 117.00 | 115.00 | 116.00 |
| 17 | **IET 29358** | 94.00 | 95.50 | 94.75 | 106.00 | 113.50 | 109.75 |
| 18 | **PUSA44** | 91.50 | 93.50 | 92.50 | 108.00 | 121.50 | 114.75 |
| 19 | **IET 29353** | 92.00 | 93.00 | 92.50 | 114.00 | 108.00 | 111.00 |
| 20 | **SIRI 1253** | 92.50 | 95.50 | 94.00 | 112.00 | 104.50 | 108.25 |
| 21 | **GNV 1806** | 95.00 | 95.50 | 95.25 | 113.00 | 113.00 | 113.00 |
| 22 | **GNV 1807** | 97.00 | 92.00 | 94.50 | 107.00 | 109.50 | 108.25 |
| 23 | **GNV 1801** | 93.50 | 93.00 | 93.25 | 114.00 | 114.00 | 114.00 |
| 24 | **GNV 1812** | 90.00 | 97.00 | 93.50 | 106.00 | 105.50 | 105.75 |
| 25 | **GNV 1803** | 93.00 | 90.50 | 91.75 | 115.00 | 117.50 | 116.25 |
| 26 | **GNV 1802** | 90.50 | 90.00 | 90.25 | 113.50 | 116.00 | 114.75 |
| 27 | **GNV 1109** | 95.00 | 92.50 | 93.75 | 109.50 | 99.50 | 104.50 |
| 28 | **GNV 1805** | 95.50 | 91.50 | 93.50 | 113.00 | 116.50 | 114.75 |
| 29 | **GNV 1804** | 97.00 | 94.00 | 95.50 | 108.00 | 99.50 | 103.75 |
| 30 | **GNV 1808** | 91.00 | 92.00 | 91.50 | 112.00 | 112.00 | 112.00 |
| 31 | **GNV 1810** | 89.00 | 90.00 | 89.50 | 115.00 | 113.00 | 114.00 |
| 32 | **GNV 653** | 90.00 | 90.00 | 90.00 | 113.50 | 112.50 | 113.00 |
| 33 | **MTU 1010** | 95.00 | 92.00 | 93.50 | 111.00 | 115.00 | 113.00 |
| 34 | **BPT 5204** | 95.00 | 90.00 | 92.50 | 110.00 | 113.00 | 111.50 |
| 35 | **GANGAVATHI SONA** | 90.00 | 93.50 | 91.75 | 113.50 | 112.00 | 112.75 |
| 36 | **CSR 22** | 93.50 | 90.50 | 92.00 | 118.00 | 106.00 | 112.00 |
|  | **Mean** | **92.47** | **92.26** | **92.37** | **110.26** | **111.46** | **110.86** |
|  | **S.Em (±)** | **3.62** | **2.74** | **2.23** | **4.81** | **5.65** | **4.27** |
|  | **C.D.(p=0.05)** | **NS** | **NS** | **NS** | **14.59** | **17.15** | **12.95** |

**4. CONCLUSIONS**

This study demonstrated significant physiological variation among 36 rice genotypes grown under high salinity stress during the *Kharif* seasons of 2021 and 2022. Key physiological parameters- including plant height, tillering ability, leaf area, leaf area index (LAI), dry matter partitioning, crop growth rate (CGR), and phenological traits revealed clear distinctions between salt-tolerant and salt-sensitive genotypes.

Genotypes such as IET 28608, CSR 23, FL478, GNV 1801, GNV 1109, CSR 22, CSR 10, SIRI 1253, and GNV 1806 consistently maintained superior physiological function under salinity stress. These genotypes exhibited higher LAI and leaf area, facilitating sustained photosynthetic activity. Greater tiller production and plant height in these genotypes also suggest enhanced carbon assimilation and efficient light interception. High CGR and total dry matter (TDM) accumulation in genotypes like GNV 1109, CSR 22, and CSR 36 indicated better metabolic efficiency, water-use optimization, and ionic homeostasis.

In contrast, sensitive genotypes such as MTU 1010 and IET 28606 exhibited reduced photosynthetic area, impaired biomass accumulation, and lower CGR-likely due to osmotic stress, ion toxicity, and inhibited nutrient uptake. Salinity-induced stress in these genotypes may have disrupted stomatal function and enzymatic activity, reducing growth and dry matter allocation, particularly in reproductive structures like panicles.

Phenological stability was evident in salt-tolerant genotypes, which maintained relatively consistent days to 50% flowering and physiological maturity, ensuring proper grain filling and reproductive success. Early-maturing genotypes like CSR 23 possibly employed a salt-escape mechanism, minimizing exposure to prolonged stress.

These findings suggest that genotypes exhibiting sustained photosynthesis, efficient biomass allocation, and stable phenological responses possess adaptive physiological traits crucial for salinity tolerance.

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Details of the AI usage are given below:

1.Chat GPT had been used for rewriting and editing the sentences

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