















Fig. 2. Morphological comparisons among different rice varieties for moderately saline soil.

**Leaf area:** The highest leaf area was found in BRRRI dhan 74 variety which was 53 cm<sup>2</sup> whereas the lowest leaf area was found for BRRRI dhan 28 variety which was 33 cm<sup>2</sup>. On the other hand, BRRRI dhan 81 and Balia variety showed 51 and 43 cm<sup>2</sup> respectively. Leaf area of BRRRI dhan 74 was significantly ( $*p \leq 0.05$ ) higher as compared to BRRRI dhan 28 and Balia rice varieties studied but insignificant for BRRRI dhan 81 rice variety. BRRRI dhan 28 and Balia rice varieties also possess significant differences. The decrease in leaf area may be due to the loss of potential efficiency of chlorophyll cause by salinity which ultimately affects the assimilation of carbon dioxide in leaves. Wankhade et al (2013) observed the reduction of bulliform cells and their dimension under salinity stress for rice plant is the main cause of reduced leaf area.

**Shoot dry weight:** The highest dry weight of shoot was found in BRRRI dhan 74 rice variety which 14.88 gm. was whereas BRRRI dhan 81 showed lowest weight which was 11.57 gm. BRRRI dhan 28 and Balia rice variety showed 13.15 and 13.9 gm. respectively. Shoot dry weight of BRRRI dhan 74 was significantly ( $*p \leq 0.05$ ) higher as compared to BRRRI dhan 81 rice variety but it was insignificant for BRRRI dhan 28 and Balia rice varieties. On the other hand, there was no significant difference between BRRRI dhan 28 and Balia variety. BRRRI dhan 74 produced the highest dry weight because of the higher accumulation of carbohydrate. This may be due to the genetic difference compared with the other rice varieties studied. Hasamuzzaman et al (2009) observed influence of genetic potentiality on dry matter production of rice under different saline condition. On the other hand Nahar et al (2018) showed variation in dry matter production for millet crop under saline condition.

**No of leaves per hill:** The highest number of leaves for rice plant was found in Balia rice variety which was 40 and the lowest number of leaves was found for BRRRI dhan 28 variety which number was 24. BRRRI dhan 74 and BRRRI dhan 81 rice varieties produced 32 and 27 leaves per hill respectably. Number of leaves of Balia variety was significantly ( $*p \leq 0.05$ ) varied with BRRRI dhan 28 and BRRRI dhan 81 but it was insignificant for the BRRRI dhan 74 rice variety. Reduction of leaf number was due to the low water potential in the leaf surface which effects on photosynthetic activity of individual leaf and the production of new leaf. Khanam et al (2018) reported that, leaf number decreases due to the accumulation of sodium chloride in the cell walls and cytoplasm of the older leaves. Alamgir and Ali (2006) found that, reduction of the formation of leaf primordia under salinity could be the probable reason for low leaf number. Zubaer et al (2007) observed the reduction of leaves for aman rice in saline stress condition.

**Tillers no per plant:** The highest number of tillers produced in BRRRI dhan 74 rice variety which was 19 and the lowest number of tillers were found both in BR 81 variety which was 11. On the other hand, BRRRI dhan 28 and Balia showed a tiller number of 13 and 15 respectively. Number of tillers of BRRRI dhan 74 was significantly ( $*p \leq 0.05$ ) higher as compared to other rice varieties studied. Reduced stomatal conductance, photosynthetic rate, transpiration rate and relative water content may be the cause for the reduction of tiller number in rice plant studied except BRRRI



dhan 74 variety. Basu et al (2010) also investigated the same result in case of diminishing of tiller number in water stress condition.

**Panicle no per plant:** BRRRI dhan 74 rice variety showed height number of panicle (16) whereas BRRRI dhan 81 produced the lowest (11) panicle per plant. BRRRI dhan and Balia produced (12) and (13) panicle per plant respectively. Number of panicle of BR 74 was significantly ( $*p \leq 0.05$ ) higher as compared to other rice varieties studied. Lowering of panicle number was recorded due to the salinity stress because of the unavailability of water at the stage of panicle initiation. Reduction of panicle number for rice in drought condition was found by Akram et al (2013).

### **Yield comparison among different rice varieties for strongly saline soil**

Fig.3. showed the yield contributing characteristics (Harvest index, 1000 grain weight, straw yield and grain yield) of different rice varieties in strongly saline soil.

**1000 Grain weight:** The highest 1000 grain weight was found in BRRRI dhan 74 rice variety which was 16.33 gm. and the lowest weight was found 12 gm. for local variety Balia. BRRRI dhan BR 81 and BRRRI dhan 28 showed 10.97 and 14 gm. grain weight respectively. BRRRI dhan 74 rice variety showed significantly ( $*p \leq 0.05$ ) higher 1000 grain weight as compared to other varieties except BRRRI dhan 28. Salt stress decreases the translocation of the food materials to the grain results in lowering of grain weight. Zubaer et al (2007) observed the degree of reduction in 1000 grain weight was different in different genotypes. The study finds that the grain of BR 74 was course in nature. As a result 1000 grain weight was found highest in this variety.

**Harvest index:** The highest harvest index (HI) was found in BRRRI dhan 28 variety which was 48.31 and the lowest index value was found in BRRRI dhan 74 variety which was 39.47. BRRRI dhan 81 and Balia showed 46.01 and 44.81 respectively. Harvest index of BRRRI dhan 28 rice variety was significantly ( $p \leq 0.05$ ) higher as compared to other rice varieties studied. BRRRI dhan 81 and Balia rice varieties showed greater significant difference with BRRRI dhan 74 rice varieties. Different harvest index was due to the genotype and the salt stress in saline condition which affects the translocation of the carbohydrate in the cultivars. Zubaer et al (2007) also found same result in water stress condition.

**Grain yield:** Grain yield included production of spikelet, pollen viability and root properties of the different rice varieties. The highest grain yield was found in BRRRI dhan 28 variety which was 3.77 t/ha whereas the lowest yield was found in BRRRI dhan 81 variety which was 2.24 t/ha. Balia and BRRRI dhan 74 showed 2.3 and 2.63 t/ha grain yield respectively. Grain yield of BRRRI dhan 28 rice variety was significantly ( $*p \leq 0.05$ ) higher as compared to other rice varieties studied. Nahar et al (2018) investigated lower yield for foxtail millet crop under saline condition. Murtaza et al (2005) observed that paddy yield depends on the salt tolerance capacity of the varieties.

**Straw yield:** The highest straw yield was found in BRRRI dhan 28 variety which was 4.93 t/ha and the lowest yield was found in BRRRI dhan 81 variety which was 3.34 t/ha. Balia and BRRRI dhan 74 showed 3.48 and 3.39 t/ha straw respectively. BRRRI dhan 28 rice variety was

significantly ( $*p \leq 0.05$ ) higher as compared to other rice varieties studied. Hasan et al (2015) observed the genotypic difference is the main cause for the variation of yield for wheat.

### Grain properties of different rice varieties in strongly saline soil

Table 3. showed the grain properties (Total grain, filled grain, unfilled grain and percent filled grain per panicle) of different rice varieties in strongly saline soil.

**Total grain per panicle:** The highest number of grain was found in BRRi dhan 28 variety which was 129 and the lowest grain number was found in BRRi dhan 81 variety which was 98. Balia and BRRi dhan 74 rice varieties produced 110 and 109 grain respectively. Total grain number of BRRi dhan 28 rice variety was significantly ( $*p \leq 0.05$ ) higher as compared to BRRi dhan 81 and BRRi dhan 74 rice varieties and insignificant with the local variety Balia. This variation may be due to the different genetic makeup of the cultivars and the varying in assimilation of photosynthetic product. Chamely et al (2015) also observed same criteria for the grain production perpanicle.

**Filled grain per panicle:** The highest filled grain was found in BRRi dhan 28 variety which was 102 and the lowest number of filled grain was found in BRRi dhan 81 variety which was 87. Balia and BRRi dhan 74 rice varieties showed 95 and 88 grain respectively. There is no significant difference among the rice varieties studied.

**Unfilled grain per panicle:** The highest unfilled grain was found in BRRi dhan 28 variety which was 27 and the lowest number of unfilled grain was found in Balia rice variety which was 15. BRRi dhan 81 and BRRi dhan 74 rice varieties showed 17 and 21 respectively. Unfilled Grain of BR 28 rice variety was significantly ( $*p \leq 0.05$ ) higher as compared to other rice varieties studied. Due to the salinity stress, the water unavailability could not provide much of the assimilate to the grain.

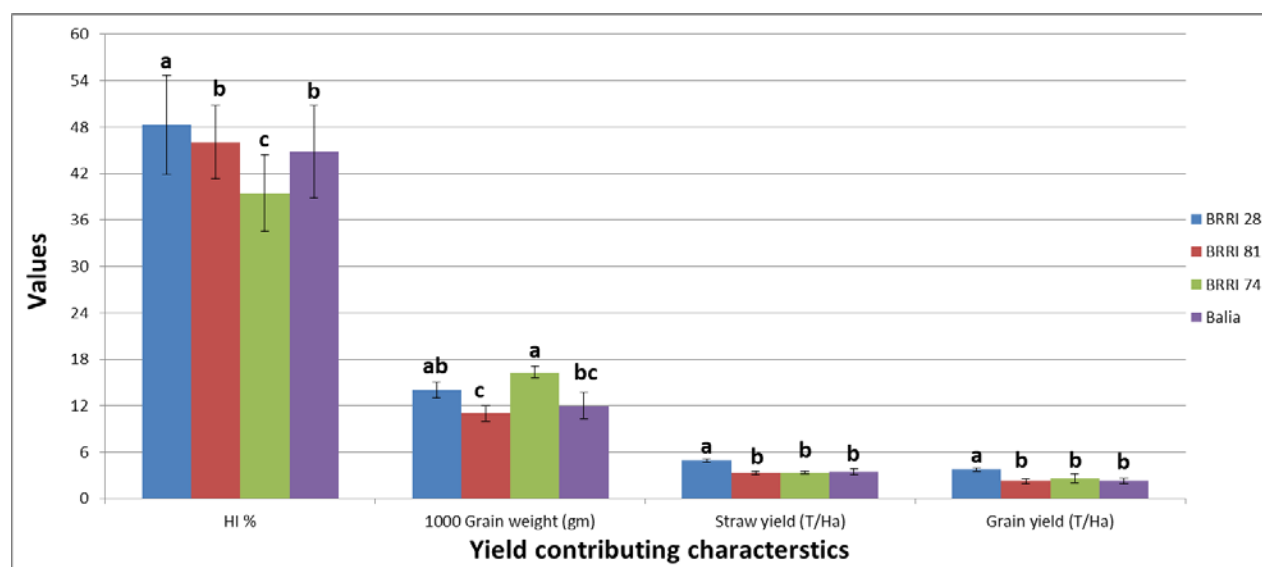


Fig. 3. Yield comparisons among different rice varieties for strongly saline soil.

**Percent filled grain:** Highest percentage of filled grain was found in Balia variety which was 86.36% and the lowest percentage was found in BRR I dhan 28 rice variety which was 79.06%. BRR I dhan 81 and BRR I dhan 74 rice varieties showed 82.85% and 80.73% of filled grain respectively. No significant difference was found for percent filled grain.

Table 3. Grain properties of the cultivars in strongly saline soil.

<i>Variety</i>	<i>Total grain/Panicle</i>	<i>Filled grain/Panicle</i>	<i>Unfilled grain/Panicle</i>	<i>%Filled grain/Panicle</i>
<b>BRR I 28</b>	129±2.12 a	102±0.71 a	27±5.29 a	79.06±4.10 a
<b>BRR I 81</b>	98±3.54 b	87±1.41 a	17±4.58 b	82.85±2.55 a
<b>BRR I 74</b>	109±5.03 b	88±3.54 a	21±3.21 b	80.73±3.58 a
<i>Balia</i>	110±4.24 ab	95±4.35 a	15±3.51 b	86.36±3.92 a

**Yield comparison among different rice varieties for moderately saline soil**

Fig.4. showed the yield contributing characteristics (Harvest index, 1000 grain weight, straw yield and grain yield) of different rice varieties in moderately saline soil.

**Harvest index:** The highest harvest index value was found in BRR I dhan 74 variety which was 42.12 and the lowest index value was found in Balia variety which was 37.18. BRR I dhan 28 and BRR I dhan 81 showed 39.8 and 38.03 respectively. Harvest index of BRR I dhan R 74 rice variety was significantly (\*p≤0.05) higher as compared to other rice varieties studied. On the other hand, the other rice varieties did not show any significant difference.

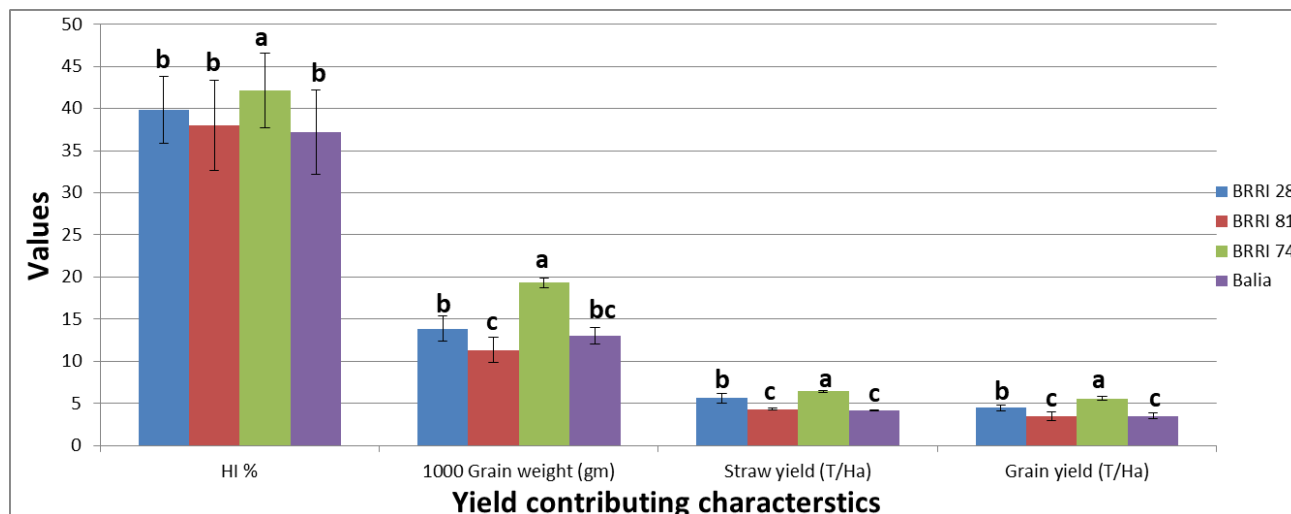


Fig. 4. Yield comparisons among different rice varieties for moderately saline soil.

**Straw yield:** The highest straw yield was found in BRRi dhan 74 rice variety which was 6.43 ton/ha and the lowest straw yield was found by Balia variety which was 4.13 ton/ha straw respectively. BRRi dhan 28 and BRRi dhan 81 rice variety produced 5.62 and 4.31 ton/ha. BRRi dhan 74 rice variety showed significantly ( $*p \leq 0.05$ ) higher straw yield as compared to other varieties. On the other hand, BRRi dhan 28 also showed significantly high compared with the other rice varieties studied. Different straw yield was found may be due to the dry matter production which is influenced by differential carbohydrate supply, vegetative growth and the genotypes. Hasamuzzaman et al (2009) also observed the influence of differential accumulation of carbohydrate supply results variation in straw yield.

**Grain yield:** The highest grain yield was found in BRRi dhan 74 rice variety which was 5.58 ton/ha and the lowest straw yield was found by BRRi dhan 81 variety which was 3.47 ton/ha. BRRi dhan 28 and Balia rice variety produced 4.45 and 3.51 ton/ha. BRRi dhan BR 74 rice variety showed significantly ( $*p \leq 0.05$ ) higher and BRRi dhan 28 also showed significantly high variation in straw yield as compared to other rice varieties studied. The variation in grain yield is due to the nutritional imbalance, deterioration of lipid metabolism, decreased photosynthesis which results in the lowering of grain quality under salt stress. Abbas et al (2013) observed same phenomenon for wheat plant. Saqib et al (2012) reported that grain yield reduces for the negative impact of salinity on number of grain and spike for wheat plant.

Table 4. Grain properties of the cultivars in moderately saline soil.

<i>Variety</i>	<i>Total grain/Panicle</i>	<i>Filled grain/Panicle</i>	<i>Unfilled grain/Panicle</i>	<i>%Filled grain/Panicle</i>

<b>BR 28</b>	140±13.44 ab	125±14.85 a	15±1.41 a	88.43±2.56 a
<b>BR 81</b>	158±0.71 a	140±1.41 a	18±2.12 a	88.48±1.04 a
<b>BR 74</b>	142±3.54 ab	127±5.66 a	15±2.83 a	89.95±1.82 a
<b>Balia</b>	133±6.36 c	125±4.24 a	8±2.12 a	91.08±1.22 a

### Grain properties of different rice varieties in moderately saline soil

Table 4.2 showed the grain properties (total grain, filled grain, unfilled grain and percent filled grain per panicle) of different rice varieties in moderately saline soil.

**Total grain per panicle:** The highest number of grain was found in BRRRI dhan 81 rice variety which was 158 and the lowest grain number was found in Balia rice variety which was 133. BRRRI dhan 28 and BRRRI dhan 74 rice varieties produced 140 and 142 grain respectably. Total grain number of BRRRI dhan 81 rice variety was significantly ( $*p \leq 0.05$ ) higher as compared with Balia rice variety but insignificant with BRRRI dhan 28 and BRRRI dhan 74 rice varieties studied. Assimilation of photosynthetic product may be the cause of the variation in grain production. Chamely et al., (2015) also observed same criteria for the grain production per panicle.

**Filled grain per panicle:** The highest filled grain was found in BRRRI dhan 81 variety which was 140 and the lowest number of filled grain was found in BRRRI dhan 28 and Balia rice variety which was 125. BRRRI dhan 74 rice variety showed 127 grain respectably. Significant variation was not found for filled grain.

**Unfilled grain per panicle:** The highest unfilled grain was found in BRRRI dhan 81 variety which was 18 and the lowest number of unfilled grain was found in Balia rice variety which was 8. Both BRRRI dhan 81 and BRRRI dhan 74 rice varieties showed 15 unfilled grains. There was no significant variation among the rice varieties studied.

**Percent filled grain:** Highest percentage of filled grain was found in Balia variety which was 98.08% and the lowest percentage was found in BRRRI dhan 28 rice variety which was 88.43%. BRRRI dhan 81 and BRRRI dhan 74 rice varieties showed 88.48% and 89.95% of filled grain respectably. No significant variation was found in present filled grain among the rice cultivars.

### Conclusion

From the study it is concluded that BRRRI dhan 74 and BRRRI dhan 28 was suited to grow in moderately and strongly saline soil conditions respectively whereas BRRRI dhan 58 was not suitable to grow in both the soils.

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