6.1 Important research findings:

To meet the increasing demand of wheat production and challenges for increasing productivity there is need of incorporation of physiological tools in to the breeding programme. This has prompted the breeders to develop varieties responsive to limited irrigation. The present study is the initiative for improving yield with some physiological traits under water stress condition. The important research findings are as follows:

6.1.1 Identification of suitable physiological traits which can be useful in wheat breeding under water stress environment.

In peninsular zone of India highest wheat yield were attained by cultivars with high biomass production, high harvest index and short growing cycle, i.e. with high crop growth rate. Grain carbon isotope discrimination appeared to be a valuable predictor of yield under PAWS, while ash content was found to be a promising indirect selection criterion for yield under WW and RSMS Misra et al., (2006). The highly significant correlation between grain carbon isotope discrimination and grain yield obtained from different treatments suggesting that this trait can also be useful for preliminary screening across environments, as suggested by Monneveux et al. (2005). The lack of association between leaf ash at boot stage, leaf ash at anthesis and grain yield The significant positive correlation between leaf ash at maturity and grain yield under WW suggest that the performance of late sampling to increase the magnitude of the correlation between leaf ash and grain yield. Positive correlation between biomass and plantlet leaf ash was found in WW condition. Grain yield was positively co related to grain CID under PAWS condition and negatively correlated with grain-ash under RSMS conditions. Grain yield was positively co related to grain CID under PAWS condition and negatively correlated with grain-ash under RSMS conditions. Significant positive correlation under RSMS and WW between leaf ash at maturity and grain yield.

CID, ash content and CTD these traits are also associated with each other and may be used as selection criteria for breeding in stress environments. However it depends on environmental conditions. Meanwhile, the use of selection index based on earliness,
vegetative biomass and grain carbon isotope discrimination and ash content could improve selection efficiency of wheat in the hot conditions of the Peninsular Zone of India.

6.1.2 Analysis of the relationship between carbon isotope discrimination, ash content, grain yield and water use efficiency components in durum wheat.

In the present study, carried out on 20 durum wheat cultivars grown during two consecutive years under residual soil moisture, limited irrigation and full irrigation, grain \( \Delta \) and \( m_a \) significantly decreased with the reduction in water availability. A significant correlation was noted between grain yield and grain \( \Delta \) across water regimes in both seasons, under full irrigation. Significant positive correlations were noted in between grain yield and leaf \( \Delta \) under residual moisture and between grain yield and leaf \( m_a \) at under limited irrigation. These results confirmed that the association between grain yield, \( \Delta \) and \( m_a \) highly depend on the climatic conditions on the year, and in particular on the quantity of water stored in the soil at sowing. In the Peninsular zone of India, the soil moisture at sowing is, in turn, mainly influenced by monsoon, out of season rainfall.

A significant correlation was found across environments between grain and leaf \( \Delta \) and \( m_a \), and T. Variation in water use efficiency (WUE) across water regimes was found to be driven more by runoff, drainage and soil evaporation than by harvest index and transpiration. The association between WUE and transpiration was negative but not significant. WUE was significantly correlated with leaf and grain \( m_a \) at maturity. The study suggested that \( \Delta \) and \( m_a \) could be used as indicators of the quantity of water transpired during the growth cycle and WUE across environments.

6.1.3 Identification of QTLs for carbon isotope discrimination, ash content and canopy temperature depression.

In the present study, a population of 140 F\(_{2:7}\) RILs were used for identification of QTLs for CID, ash content and CTD. Analysis of variance showed significance for ash content, carbon isotope discrimination and canopy temperature depression under limited and well watered environment. Grain yield showed significant correlation for
canopy temperature depression, ash content and carbon isotope discrimination. Grain yield showed significant negative correlation for canopy temperature depression. For carbon isotope discrimination and ash content grain yield showed significant positive correlation.

In composite interval analysis, total 6 main effect QTLs were identified for carbon isotope discrimination, ash content and canopy temperature depression. QTLs obtained during this study are listed as follows:

- Significant QTL were obtained for ash content at WW condition on chromosome 1B and 6A for the marker interval Xgwm550-GluB3 and Xgwm82-Xpsp3009.3 at the LOD value 2.85 and 4.23 respectively.
- Significant QTL was obtained for ash content at LI condition on chromosome 5AS for the marker interval Xgwm205.1- Xgwm154 at the LOD value 3.59.
- Carbon Isotope Discrimination has got significant QTL under WW condition on chromosome 4B for the marker interval Xgwm368-Xwmc48.2 at LOD value 3.70.
- Significant QTLs were obtained for canopy Temperature Depression at WW condition on chromosome 7A and UL3 group for the marker interval Xgwm276-Xcfa2123 and Xgwm459-Xwmc630.1 at LOD value 3.14 and 3.53 resp.

This work may be considered as a preliminary work carried out by us. This is only single year data. However phenotyping at more locations must be conducted in order to validate the present QTL.