



Study of changes in wheat biomass in two conventional and raised bed cropping systems under different irrigation regimes

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Abstract

To evaluate effect of sowing systems and fertilizers on the growth of wheat (*Triticum aestivum* L.) an experiment was done based on Randomized Complete Block Design (RCBD) in three replications at Urmia University. Treatments were Conventional cultivation with full irrigation (CF), Conventional cultivation with deficit irrigation (CD), Raised Bed cultivation with full irrigation (RF), Raised Bed cultivation with deficit irrigation (RD) and Raised Bed cultivation Mycorrhized deficit irrigation (RMD). Leaf weight, stem weight and spike weight changes for all treatments had a cubic relationship with time. Initially, leaf weight showed an increase and then a slow decrease until stage 7. At the end of the growth period, it was accompanied by a rapid increase. For the raised bed planting systems, a rapid increase of stem weight was observed first until stages 2 and 3 and then a decrease until the end of the growing period. However, the stem weight at the end of the growing period was close for all treatments. In raised beds, for all three groups of Raised Bed cultivation, spike weight increase was obtained and then these values remained constant, but it also showed a decrease in the last two stages for Conventional cultivation.

Introduction

A raised bed sowing system with a number of defined rows planted on top of the bed with furrow irrigation was found to overcome these disadvantages the advantages of raised bed. Sowing system with furrow irrigation compared with conventional flat sowing with flood irrigation (Hesham *et al.*, 2020). Conventional flat sowing is frequently used for growing wheat and the crop is irrigated by flood irrigation, but it pointers to ineffective use of applied nitrogen owing to poor aeration and leaching and volatilization losses (Subhash and Anup, 2017). Arbuscular Mycorrhizal (AM) symbiosis is integral to sustainable agriculture and enhances plant resilience to abiotic and biotic stressors. Through their symbiotic association with plant roots, AM improves nutrient and water uptake, activates antioxidant defenses, and facilitates hormonal regulation, contributing to improved plant health and productivity (Ahmed *et al.*, 2025). The objective of this study was to evaluate the effect of sowing systems and fertilizers on the on the growth of wheat.

Materials and methods

To evaluate effect of sowing systems and fertilizers (Conventional cultivation with full irrigation (CF), Conventional cultivation with deficit irrigation (CD), Raised Bed cultivation with full irrigation (RF), Raised Bed cultivation with deficit irrigation (RD) and Raised Bed cultivation Mycorrhized deficit irrigation (RMD) on the growth of wheat (*Triticum aestivum* L.) an experiment was done based on Randomized Complete Block Design (RCBD) at Urmia University (37.53 N and 45.08 E, altitude 1320 m). In RMD treatment, biological fertilizer included the mycorrhizal inocula, nitrogen (Azeto Barvar. 1), phosphorus (Phosphate Barvar2) and potassium (Barvar 2 Biofertilizer). The chemical fertilizers were NPK (nitrogen, phosphorus, potassium). The 5 plants of per plot were harvested and their leaves, stems and spikes were dried to determine weights for sampling stages. Sampling stages included 166, 171, 177, 182, 187, 193, 199, 204 and 210 Days After Sowing (DAS). The leaf relative water content (RWC) were measured for five stages (166, 171, 177, 182 and 187 DAS). The regression analysis was done for leaf, stem and spike weight for nine sampling stages. The analysis of variance (ANOVA) for RWC data and the means comparisons were done based on LSD test using SAS 9.13 software.

Results and discussion

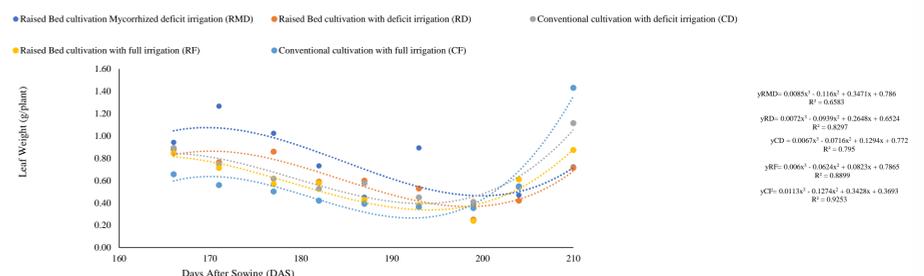


Figure 1– Regression relationships of leaf weight during growing period for Conventional cultivation with full irrigation (CF), Conventional cultivation with deficit irrigation (CD), Raised Bed cultivation with full irrigation (RF), Raised Bed cultivation with deficit irrigation (RD), Raised Bed cultivation Mycorrhized deficit irrigation (RMD)

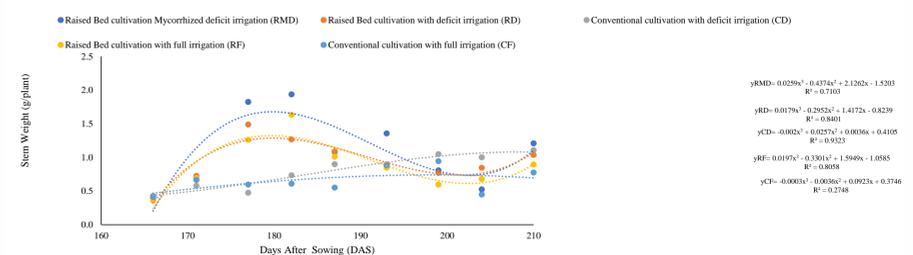


Figure 2- Regression relationships of stem weight during growing period for Conventional cultivation with full irrigation (CF), Conventional cultivation with deficit irrigation (CD), Raised Bed cultivation with full irrigation (RF), Raised Bed cultivation with deficit irrigation (RD), Raised Bed cultivation Mycorrhized deficit irrigation (RMD)

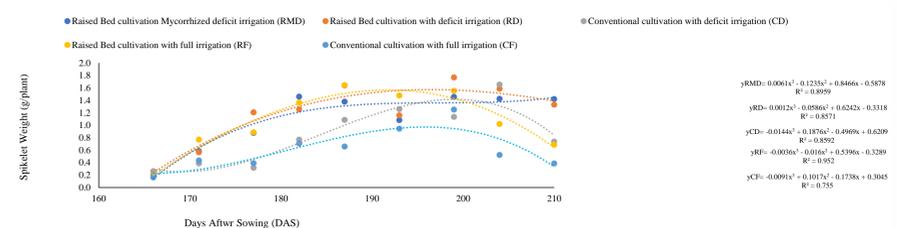


Figure 3- Regression relationships of spikelet weight during growing period for Conventional cultivation with full irrigation (CF), Conventional cultivation with deficit irrigation (CD), Raised Bed cultivation with full irrigation (RF), Raised Bed cultivation with deficit irrigation (RD), Raised Bed cultivation Mycorrhized deficit irrigation (RMD)

Table 1. Analysis of variance (mean of squares) of the effect of treatments on the leaf RWC (Five sampling stages) of Wheat.

Source of variation	df	166DAS	171DAS	177DAS	182DAS	187DAS
Block	2	22.0792867**	27.612247**	127.4532067**	13.6806200**	91.9536867**
Treatment	4	43.9994567**	333.623827**	101.5516900*	108.5383067*	201.9144067**
Error	8	35.5262117	187.253572	41.6737400	26.3652367	11.946737
Coefficient of Variation (%)		9.137587	21.93615	9.153217	7.220188	4.864796

ns: not significant, * and **: significant at 5% and 1% probability level. DAS: days after sowing.

Table 2. Means comparison of leaf RWC (Five sampling stages) of Wheat affected by experimental treatments.

treatment	166DAS	171DAS	177DAS	182DAS	187DAS
Raised Bed cultivation Mycorrhized deficit irrigation (RMD)	69.053 ^a	72.72 ^a	75.550 ^a	75.603 ^a	80.297 ^a
Raised Bed cultivation with deficit irrigation (RD)	69.567 ^a	63.23 ^a	60.893 ^b	61.613 ^b	65.003 ^b
Raised Bed cultivation with full irrigation (RF)	61.460 ^b	53.29 ^b	74.670 ^a	68.643 ^{ab}	60.193 ^b
Conventional cultivation with full irrigation (CF)	63.863 ^b	72.57 ^a	70.973 ^{ab}	74.603 ^a	74.843 ^b
Conventional cultivation with deficit irrigation (CD)	62.203 ^b	50.10 ^b	70.550 ^{ab}	75.117 ^a	74.910 ^b

The dissimilar letters in each column show significant differences at P ≤ 0.05. . DAS: days after sowing.

References

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