Sustainable Production of Bread Wheat Using LASER Land Levelling and Sowing Methods as Potent Regulators of Carbon Sequestration, Fuel Consumption and Water Use under Arid Environment of Bahawalpur

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ABSTRACT

Background: Excessive use of water in wheat accompanies fuel consumption and emission of carbon dioxide in environment.

Objectives: The study was conducted with objectives to decrease water use, associated fuel consumption and carbon dioxide emission; and to improve the productivity of wheat on sustainable basis using LASER levelling and sowing methods as potent modulator of these adversities.

Methodology: The experiment was conducted at research area of Agronomic Research Station Bahawalpur over three years using split plot experimental design and four replications. Treatments were contained of LASER levelling in main plot viz. L_0 = No LASER levelling; L_1 = LASER levelling and sowing methods in split plots viz. S_1 = broadcast; S_2 = ridge sowing and S_3 = drill sowing.

Results: Lesser water use, fuel consumption and emission of carbon dioxide were quantified under "LASER levelling" and under "ridge sowing" compared to other treatments. While, more fertile tillers, grains per spike, 1000-grain weight and grain yield were quantified under "LASER levelling" than "no LASER levelling" and under "ridge sowing" compared to broadcast and drill sowing of wheat.

Conclusion: Conclusively, “LASER levelling” and “ridge sowing” effectively decreased the use of water, fuel consumption, carbon dioxide emission and improved the grain yield and yield components of wheat compared to other treatments. Moreover, strong negative associations of water use, fuel consumption and carbon dioxide emission with grain yield of wheat were recorded.

KEYWORDS: Climate change, correlation**,** environment conservation**,** sustainability**,** water scarcity, wheat

INTRODUCTION

According to an estimate, 101.8 million people have been affected by various disasters around the globe during year 2021. Among these, 51.3 million masses were affected by droughts with more frequent events in Africa and Asia. Accelerated emission of carbon dioxide due to excessive burning of fuel has also deteriorated the quality of air in Pakistan. Water use in wheat can be decreased using different soil manipulation techniques. Sowing method and LASER levelling are imperative stratagems to regulate water use, fuel consumption, emission of carbon dioxide and yield components of wheat crop. Adapting water and fuel-efficient sowing method for wheat will not only ensure food security but also sustain environment by decreasing the emission of carbon dioxide, water use and fuel consumption.

METHODOLOGY

The study was conducted at Research Farm, Agronomic Research Station, Bahawalpur Pakistan during winter seasons of 2015-16, 2016-17 and 2017-18. Experiments was laid out using Randomized Complete Block Design under split treatments structure and replicated four times. Difference of treatments was determined using ANOVA at 5% probability and Tukey’s HSD (Honestly significant difference) test was employed for computation of comparison of means. To compute use of water at 1st, 2nd, 3rd and 4th irrigation, discharge was measured with help of cut throat flume.

$V = Q \times T \times N$

Where V = Volume of water used (m3 ha-1); Q = Discharge (m3 h-1); T = Time taken to irrigate each experimental unit (h); N = Number of irrigations.

Fuel consumption at each irrigation was measured by determining volume of diesel consumed at each irrigation to irrigate each experimental unit.

$F = X/Y \times Z$

Where F = Fuel consumed at each irrigation (L ha-1); X/Y = Consumption of diesel by engine per unit time (L h-1); Z = Time taken to irrigate each experimental unit (h).

Emission of carbon dioxide was measured using formula

$CO_2=F \times 2.70$

Where CO2 = Carbon dioxide emitted during irrigation (kg ha-1); F = Fuel consumed at each irrigation (L ha-1); 2.70 = Fuel consumption factor for diesel engine.

RESULTS

Figure 1: Effect of LASER land levelling and sowing methods on grain yield (t ha^{-1}) of wheat

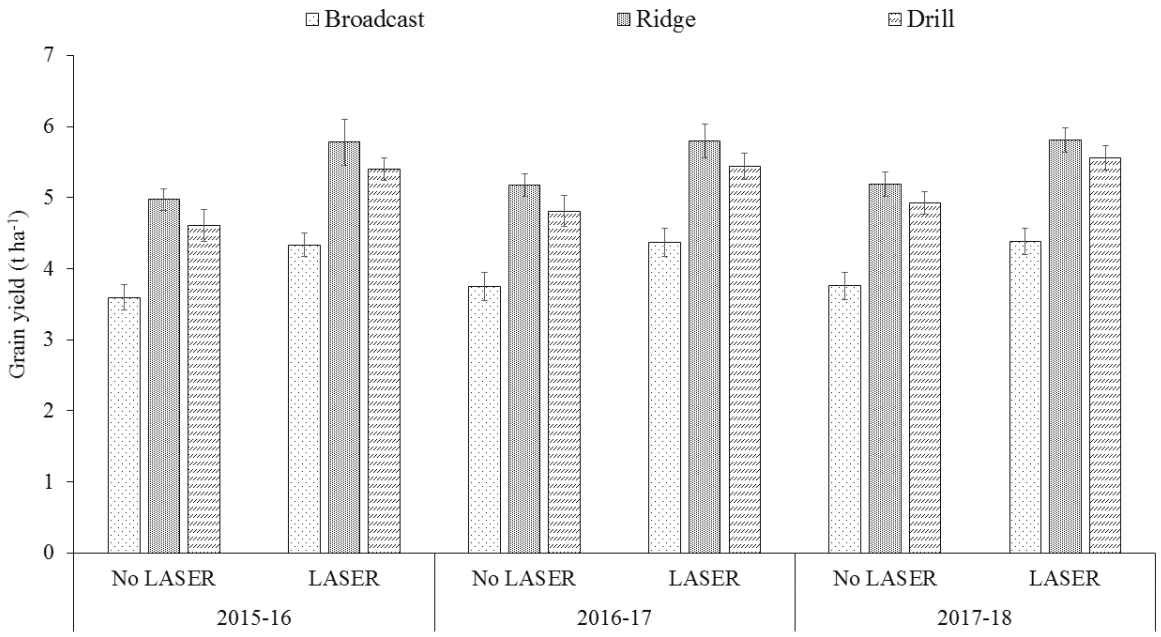


Figure 2: Effect of LASER land levelling and sowing methods on water use (m^3 ha^{-1}) of wheatS

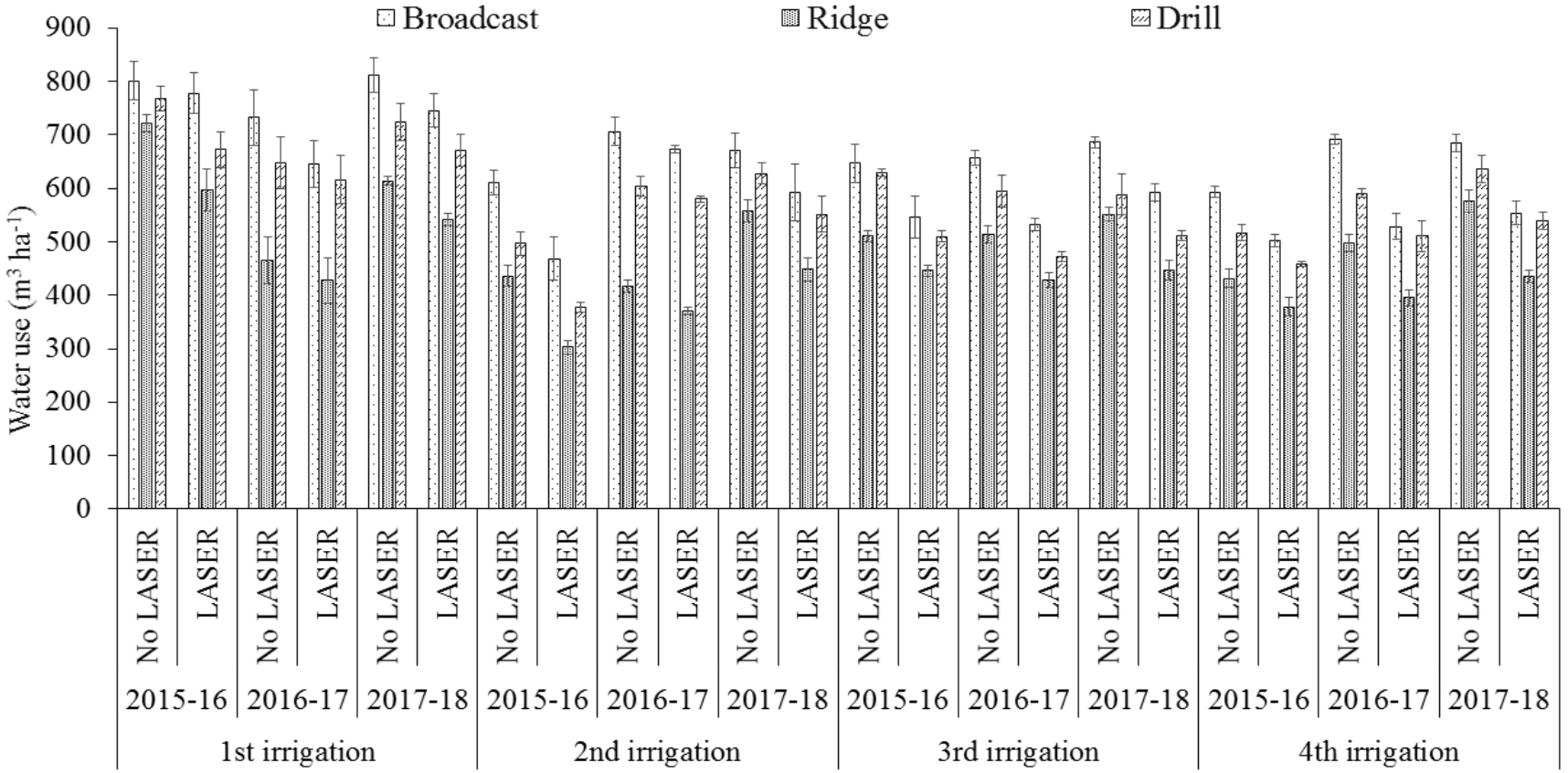
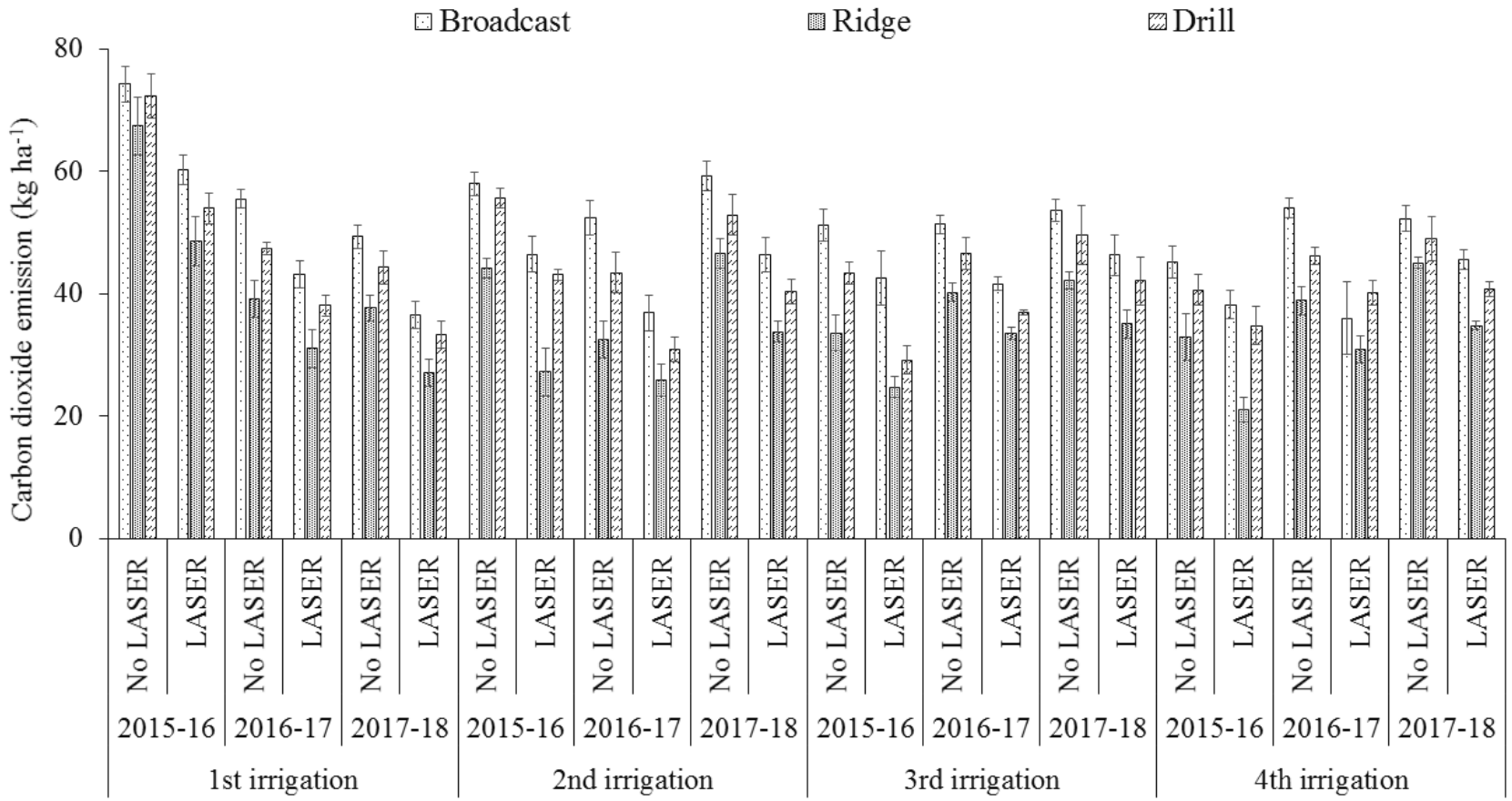


Figure 3: Effect of LASER land levelling and sowing methods on carbon dioxide emission (kg ha^{-1}) from fuel consumption during irrigation of wheat



CONCLUSION

“LASER levelling” and “ridge sowing” effectively decreased the use of water, fuel consumption, carbon dioxide emission and improved the grain yield and yield components of wheat compared to other treatments. Moreover, strong negative associations of water use, fuel consumption and carbon dioxide emission with grain yield of wheat were recorded.