

Effect of high temperature at flowering stage of boro rice varieties under different soil moisture levels



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Abstract

Changing climate rises air temperature due to increasing concentration of CO₂ and other atmospheric greenhouse gases. The rise in atmospheric temperature causes detrimental effects on growth, yield, and quality of the crop varieties by affecting their phenology, physiology, and yield components. Boro rice is transplanted in January-February and usually faces high temperature (36-39 °C) at its reproductive stage in April-May. Flowering stage of rice is very critical for high temperature. High temperature may cause drying of pollen and stigma and ceasing pollen tube development for fertilisation. As a result, unfilled grains are produced. The experiment was carried out at BINA, Mymensingh, Bangladesh during December 2019 to May 2020 with three boro rice varieties. The objective of the study was to estimate proper soil moisture level at flowering stage to reduce high temperature effect. So, Binadhan-5, Binadhan-10 and Binadhan-14 were grown in pots each of 8 kg soil in ambient temperature and those were kept at 38 °C at flowering stage for 24 hours under different soil moisture levels (80% FC, 100% FC and 2 inches standing water) in plant growth chamber. Then all the plants were again continued to maturity under sufficient soil moisture in ambient condition. The experiment was conducted in CRD with three replications. Data on photosynthetic parameters, yield and yield attributes were recorded. The results revealed that high temperature significantly decreased photosynthetic rate and yield and increased transpiration rate and unfilled grains. Higher transpiration rate maintained T leaf of 33-34 °C during T air of 38 °C. Better yield with less sterility was found in 100% FC and standing water of 2 inches compared to 80% FC. So, maintain 100% FC or standing water of 2 inches at flowering stage of rice can reduce high temperature effect.

Introduction

Global climate change is making high temperatures a critical factor for plant growth and productivity. The flowering stage of rice is critical for high temperatures. Maintaining proper soil moisture level at this stage is very important to reduce yield loss.

Objective

To assess the effect of high temperature at flowering stage under different soil moisture levels

Materials and Methods

In pots containing each of 8 kg soil, 3 boro rice varieties (Binadhan-5, Binadhan-10 and Binadhan-14) were grown normally at ambient temperature. During the flowering stage, these plants were kept in plant growth chamber at 38 °C for 24 hours under 3 soil moisture levels (80% FC, 100% FC and 2 inches standing water) in pot soil. Then all the plants were again allowed to complete their maturity at ambient temperature.

Results

Photosynthesis, transpiration and yield per plant decreased but water use efficiency increased more at 80% field capacity (Fig. A, B, C and D). The results conform with the researchers [1] [2] [3]. Binadhan-5 and Binadhan-10 maintained lower temperature levels compared to Binadhan-14 and showed more tolerance (Fig. E).

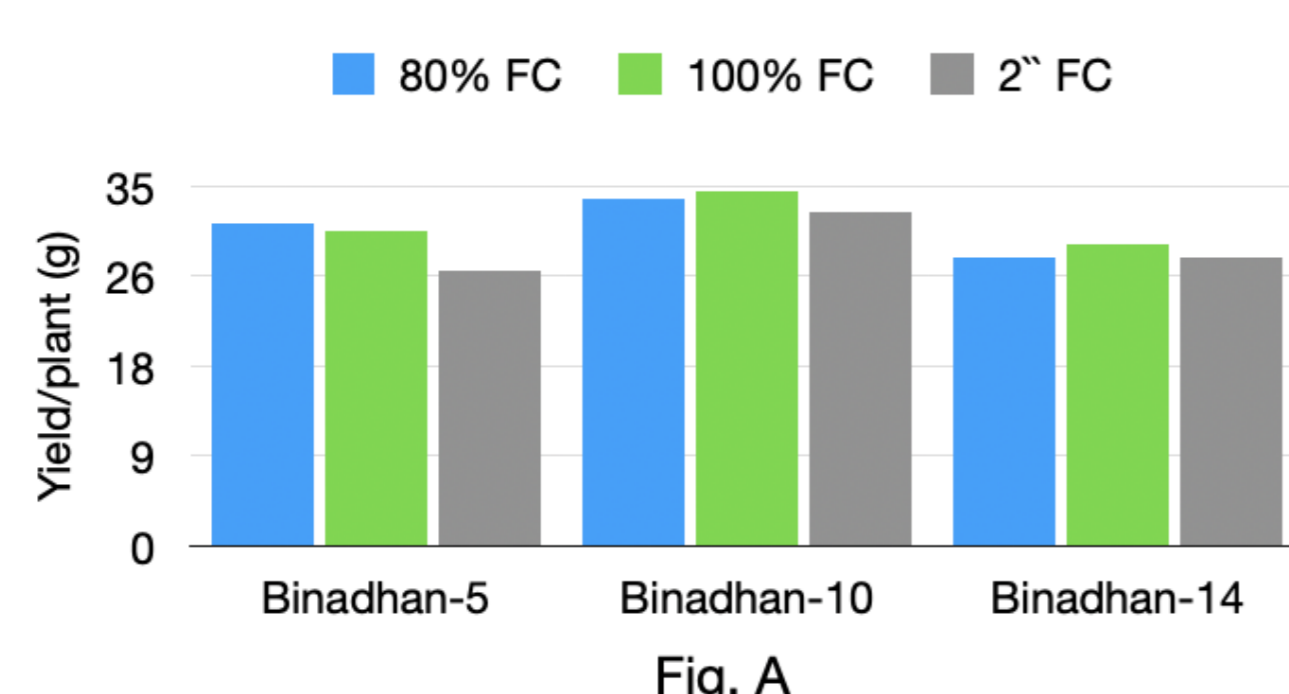


Fig. A

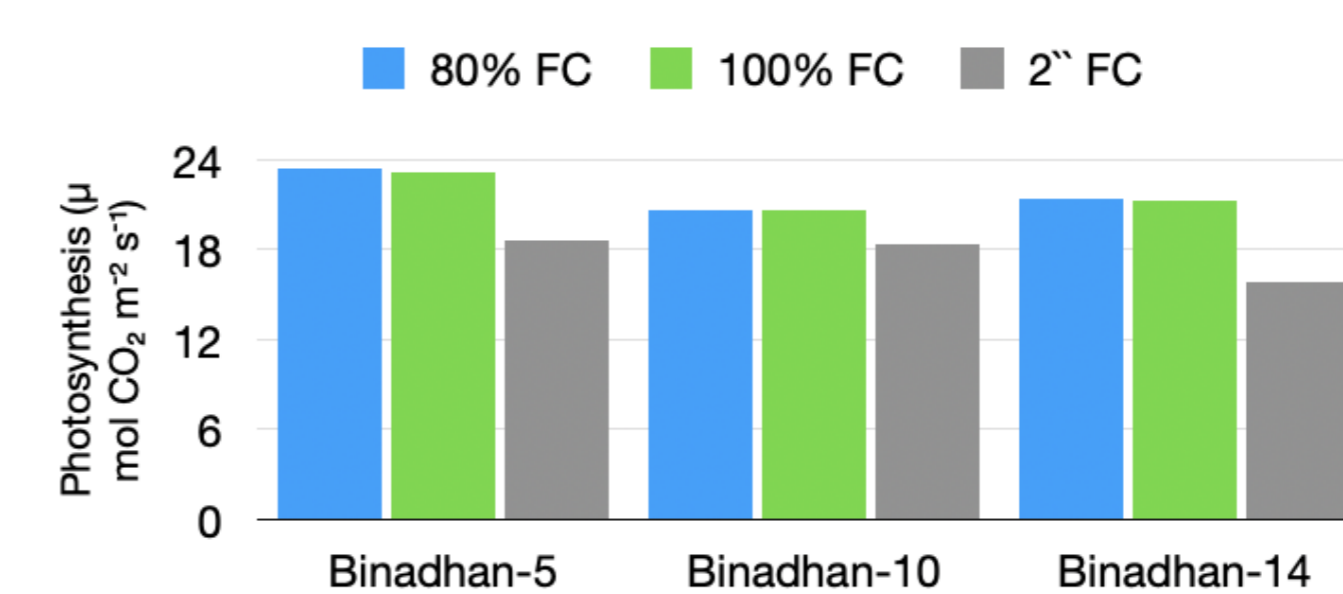


Fig. B

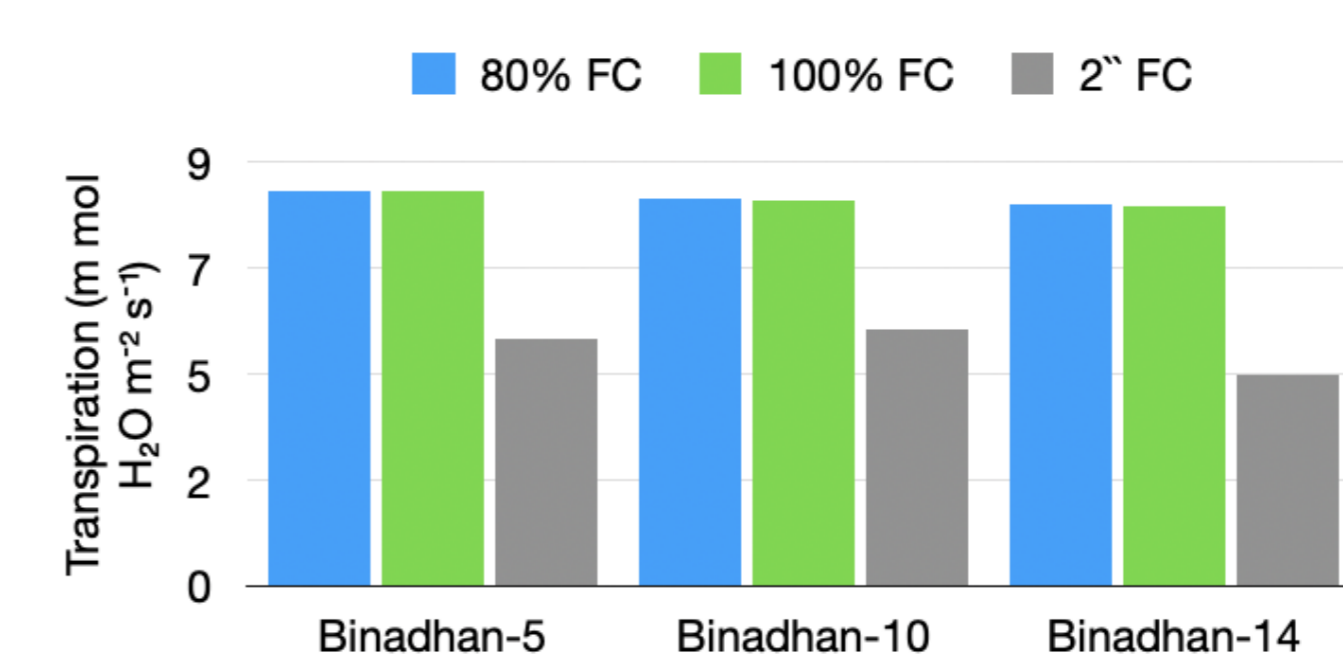


Fig. C

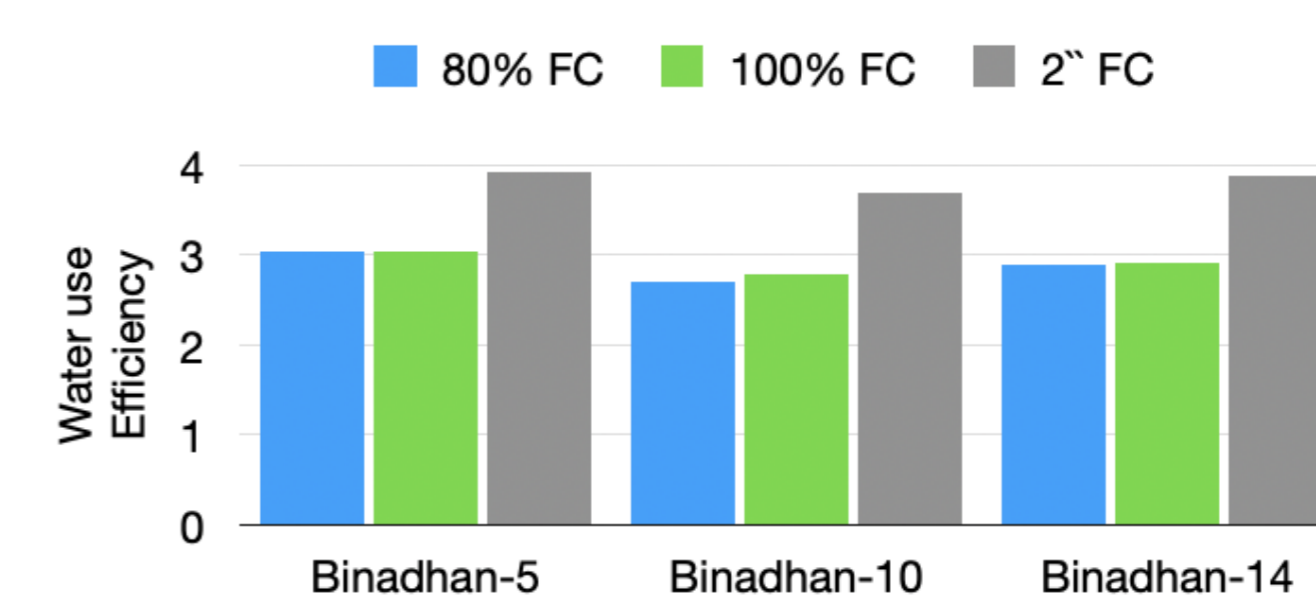


Fig. D

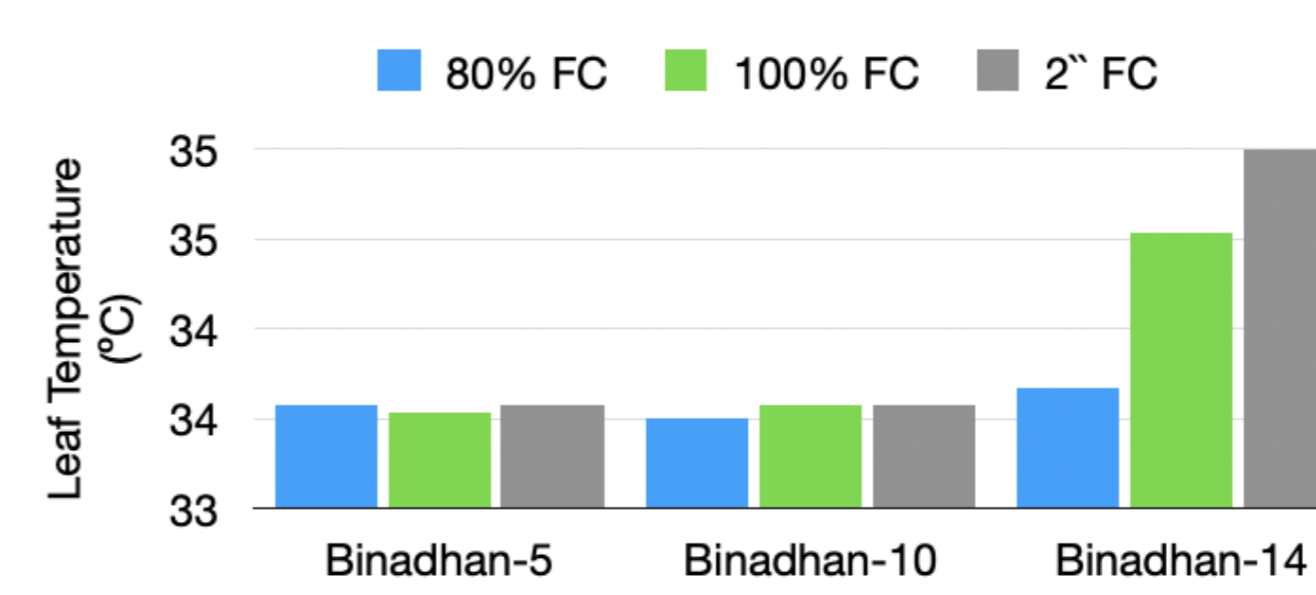


Fig. E

Figures show yield (Fig. A), photosynthetic rate (Fig. B), transpiration rate (Fig. C), water use efficiency (Fig. D) and leaf temperature (Fig. E) of 3 rice varieties under 3 soil moisture levels

Conclusion

- Maintain soil moisture at 100% field capacity level or standing water of 2 inches can reduce the high-temperature effect of boro rice varieties at the flowering stage.

References

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- [2] M. T. Islam. Effect of temperature on photosynthesis, yield attributes and yield of aromatic rice genotypes. *Int.J.Sustain Crop Prod.*, 6(1):14–16, 2011.
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