Climate Challenge on Australian Rice Production – A Comparison in Two Climatic Zones

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Abstract
More than half of the world's population consumes rice as the staple food and Australia produces 1.2 million tons of rice per year feeding around 40 million people daily. Future climate change predicts increase temperatures and reduction in water availability due to reduced rainfall. Rice production heavily relies on climatic changes especially atmospheric temperature and rain fall. This study evaluated the responses of different rice varieties to change in temperature (associated with elevated atmospheric CO_2 concentration) and rainfall using APSIM–Oryza model at two sites, Griffith/ Riverina in New South Wales and Kununurra in Western Australia. Varieties used at Riverina were Amaroo, Langi, and Quest, representing late, mid and early maturity types, respectively. Variety (IR72) was used for Kununurra region. Five different changes of temperature were 0 (base temperature 30^0C), +1, +2, +3, +4^{o}C with a combination of five rainfall changes (+10, 0, -10, -20, and -30%) used in the simulation to represent the series of projected climatic changes predicted for Australia over the next 60 years. The corresponding CO_2 concentrations allied with above temperature levels were 380, 435, 535, 640 and 750 ppm. All three rice varieties in two Riverina climatic zones showed a yield increase of 0.36 tons/ha (up to 10%) with increase in temperature by 2^o C at Griffith, which could be due to CO_2 fertilization effect. Further increase in temperature caused a steady decline in yield, with short season variety 'Quest' affected least. Grain yields at Kununurra steadily declined by 37% with 4^{o}C increase in temperature. These results indicated that warmer temperatures would increase spikelet sterility. Adaptations could be included, use of shorter season varieties and changing planting dates. In the above two different climatic zones, higher temperature is expected to limit rice production in future.

Keywords: Climate change, CO_2 elevation, Rice, Yield components

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