ABSTRACT

Rice production needs to be increased to meet the food demand of the rising population, which is evoked by climate change. Since cultivable land is not going to be increased in future, the required rice production must be obtained from limited available resources. Previous research showed that reducing yield gap between potential and farmers' actual yield could be one of the promising strategies for increasing rice production. It was noted that most of the yield gap studies have concentrated on crop management issues, and only a few studies examined about how climate change may affect uncertainty in rice yield gap assessments. Moreover, the accuracy of the regional yield gap estimate was compromised by the exclusion of regionally dispersed fine resolution weather and soil information from the study site. Finally, the studies on climate change adaptation did not consider yield gap analysis, which might offer the widest possible range of yield enhancement through adaptation alternatives. To address all these research gap, the present study has been planned to close the rainfed rice yield gap in India by identifying the most economically feasible agronomic adaptation approaches by considering impact of climate change and management factors on rice yield. Decision Support System for Agro-technology Transfer (DSSAT) model was used to simulate potential yield and yield in-response to management options for assessing the yield gap. Bias-corrected Representative Concentration Pathway (RCP) 4.5 and 8.5 scenarios of three regional climate models (RCMs), namely- HadGEM3-RA, RegCM4, and YSU_RSM were used to analyze the impact of climate change on the yield gap for the future periods (2030s and 2040s). Field experiment results indicated that farmers' conventional agronomic practices might reduce the average rice yield by 0.29 t/ha. The DSSAT simulated results showed that climate change could reduce the rice yield from 2.13 to 1.62 t/ha in the future, whereas the mean rainfed yield gap of 1.40 t/ha will still exist in the study area. There will be an increasing yield gap of 20.9% and 22.2%, a stagnant yield gap of 29.7% and 26.5%, and a declining yield gap of 49.4% and 51.3% of the study area in future. The combined adjustments in transplanting time (advanced by fortnight), crop spacing (10 cm × 10 cm) and nitrogen fertilizer application (140 kg/ha) could be the best strategy to close the yield gap under climate change scenario that may improve rice yield by 37.5–168.0% and reduce the average yield gap among the cultivars from 0.74-0.16 t/ha. This study provides futuristic yield enhancement strategy to rice growers and lays the basis for an economic analysis to support policymakers in-charge of promoting the sustainability of the rainfed rice growing systems.

Keywords: Yield gap; Climate change; Agronomic adaptation; DSSAT; Rice; India.