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RESEARCH ARTICLE

APSIM-based insights for enhancing rice productivity and climate change adaptation in the north-eastern hilly regions of India

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Abstract

Rising temperatures and increasing extreme climate events are expected to significantly affect crop yields, including rice production in India. Understanding the responses of different rice genotypes to these climate changes is critical for climate-resilient agriculture. This study assessed the performance of two rice varieties, Shahsarang and Mendri, under varying Soil Organic Carbon (SOC) levels, nutrient management practices and projected climate scenarios. The Shahsarang variety, under baseline conditions, achieved a mean grain yield of 4930 kg/ha in high SOC soils when nursery was sown in early May, while medium and low SOC soils produced 4644 kg/ha and 4212 kg/ha, respectively. By the mid-century (2050), intermediate emission scenarios projected yield reductions of 3 %, 9 % and 12 % for low, medium and high SOC soils, respectively, relative to the respective baselines. In contrast, the Mendri variety demonstrated a yield advantage of 417-1318 kg/ha in high SOC soils under mid- and late-century scenarios. Additionally, following Integrated Nutrient Management (INM) using FYM resulted in increased SOC compared to conventional farmers' practices. In the present study, C1 (low SOC) soil, the impact of 33-year continuous rice monocropping revealed that applying FYM @ 10 t/ha led to SOC accumulation under 75 % RDN in Shahsarang. While in the Mendri variety, three treatments exhibited positive trends ranging from 0.86 to 2.36 %. However, soils with high carbon content showed limited response to additional inputs. Hence, our study suggests the importance of evaluating genotype-specific responses and soil interactions to develop climate-resilient rice production strategies.

Keywords: climate change; grain yield; rice; soil organic carbon; sustainability

Introduction

Rice is a staple crop extensively cultivated across South Asia, having a fundamental impact in ensuring food security and sustaining the livelihoods of millions of people. Urbanization and rising incomes have contributed to declining per capita rice consumption in many middle- and high-income Asian nations. However, in lower-income countries, a significant portion of the population still faces unmet demand for rice. In these regions, rice consumption is projected to increase, highlighting the necessity of resilient rice production systems (1). Rice cultivation faces severe threats from climate change, particularly from rising temperatures and erratic rainfall patterns (2). These challenges are especially pronounced during key growth stages like flowering and grain filling, where heat stress can result in substantial yield loss of 15.7 to 25 % in some regions of India (3). To meet the future global demand for rice, sustainable increases in rice production must be achieved in Southeast Asia's primary rice-growing regions. This approach aims to prevent further land conversion to agriculture while minimizing the environmental and health impacts of intensive farming practices (4). The northeastern hill (NEH) region of India, which predominantly follows a rice-fallow cropping system, is particularly susceptible to these climate impacts (5). Further, the implementation of various INM practices, which involve the combined use of organic manures and inorganic fertilizers, is gaining recognition. It is considered one of the most effective approaches to maintaining healthy and sustainable soil systems (6, 7). This method not only enhances crop productivity but also plays a vital role in restoring SOC in depleted and degraded soils while simultaneously boosting yields. Sustaining and improving rice productivity in the NEH region is vital to addressing the rising food demands of an expanding population (5). There is a critical need to evaluate potential yield losses and assess how different rice varieties respond under projected climate scenarios in this agroecological zone. Such insights are essential for developing region-specific strategies to support sustainable rice production, ensure long-term food security and promote environmental sustainability.

Materials and Methods

Field experiments

Two separate field experiments were conducted for Shahsarang and Mendri varieties of rice during the kharif season of 2023 on a lowland rice field at the Agronomy Farm of the Indian Council of Agricultural Research (ICAR) Research Complex for the Northeastern Hill Region (NEH), Umiam, Meghalaya, India (25°41'N; 91°45'E). The site is situated in a subtropical region characterized by average monthly temperatures ranging from 13.9 °C in January to 24.3 °C in August. The southwest monsoon typically begins in July and extends through September, accounting for 70 % of the total annual rainfall. Fertilizer application was based on a recommended dose of 80:60:40 kg $N:P_2O_5:K_2O$ per hectare (8). Nitrogen, phosphorus and potassium were applied using urea, single super phosphate (SSP), diammonium phosphate (DAP) and muriate of potash (MOP). Half of the nitrogen dose (specific to the defined treatments) and the entire dose of phosphorus and potassium were broadcast at sowing. The remaining nitrogen was applied in two equal splits at the maximum tillering and flowering stages, respectively. The soil texture of the study site was clay loam with acidic nature (pH=4.7) and a high level of SOC, ranging from 1.81 to 2.01 %. Additional soil properties are given in Table 1.

Crop modelling

Using APSIM (Agricultural Production Systems sIMulator) model (9), we have evaluated the rice varieties, Shahsarang and Mendri, under three soil carbon gradients (C1, C2 and C3), representing SOC distributions observed in farmers' fields (Table 2). The APSIM model, calibrated and validated using experimental data, was employed to simulate crop performance (Fig. 1). Long-term simulations were performed over 30 years under 100 % RDN dose and the crop was sown in the first fortnight of May (constant sowing date) to analyze grain yield variability under different management practices and climate scenarios. Climate change projections were based on Representative Concentration Pathways (RCPs) from the IPCC Fifth Assessment Report (AR5) (10). These RCPs represent different greenhouse gas concentration trajectories. Each is associated with a specific radiative forcing target by 2100: RCP 2.6 (2.6 W/m^2) represents a low-emission scenario; RCP 4.5 (4.5 W/m^2) and RCP 6 (6 W/m^2) represent intermediate scenarios; and RCP 8.5 (8.5 W/m^2) represents a high-emission scenario. This study primarily focused on RCP 4.5 and RCP 8.5, which represent intermediate and high emission scenarios for the mid (2040-2069) and late (2070-2099) centuries. To obtain accurate climate projections, Bias-Corrected and Spatially Disaggregated (BCSD) monthly data on rainfall and temperature from the Coupled Model Intercomparison Project phase 5 (CMIP5), developed by the World Climate Research Program (WCRP), were utilized. Projected atmospheric CO_2 concentrations were obtained from the RCP database (11). Further, to assess the influence of different nutrient management on SOC, a scenario analysis was conducted using long-term simulations with three soil carbon gradients (Table 2). Nutrient management scenarios were based on feasible nitrogen management options previously evaluated for effectiveness at the experiment station (Table 3).

Table 2. Details of categorization of soil scenarios based on carbon gradients

Soil depth (cm)	Soil Organic Carbon content (%)		
	C1 soil (Low)	C2 soil (Medium)	C3 soil (High)
0-15	1.49	2.12	3.11
15-30	1.32	1.65	2.69
30-60	1.07	1.58	1.58
60-90	0.9	1.02	1.02
90-120	0.71	0.92	0.87

Table 1. Initial physical and chemical properties of soil at the experimental site

Soil depth (cm)	Sand (%)	Silt (%)	Clay (%)	OC (%)	Available-N (kg/ha)	Available-P (kg/ha)	Available-K (kg/ha)
0-15	43.7	18.1	38.2	2.0	284.3	13.4	174.2
15-30	41.6	18.2	40.2	1.7	269.3	10.9	151.1
30-60	39.4	15.5	45.1	1.6	240.0	9.6	147.2
60-90	38.3	14.5	47.2	1.3	213.2	8.3	95.1

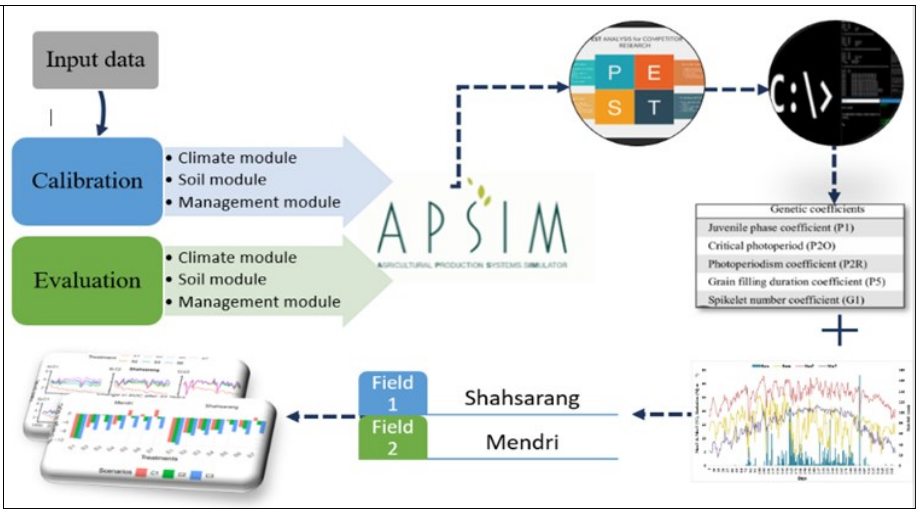

Fig. 1. Flow-chart describing the process of modelling, calibration and evaluation of the APSIM model.

Table 3. Description of different treatments of scenario analysis

Treatments	Description
S1	Control
S2	75 % RDN-recommended dose of nitrogen
S3	100 % RDN
S4	50 % RDN + 5 t/ha FYM
S5	50 % RDN+10 t/ha FYM
S6	75 % RDN+ 5 t/ha FYM
S7	75 % RDN+10 t/ha FYM

Results

Our study highlights the variations in the grain yield of the Shahsarang and Mendri rice varieties under different climate scenarios and SOC gradients. For the Shahsarang variety under the baseline scenario, the grain yield in high SOC soils was 4930 kg/ha. In contrast, medium and low SOC soils exhibited lower yields of 4644 and 4212 kg/ha, respectively (Fig. 2). SOC Relative to the baseline scenario by the mid-century (2050), intermediate emission scenarios projected yield reductions of 3 %, 9 % and 12 % for low, medium and high SOC soils. In comparison to the baseline scenario the high carbon soil for Shahsarang during the mid-century (2050) and late-century (2080), intermediate emission scenarios there was a yield reduction of 590 and 630 kg/ha, which stretches further to ~800 kg/ha and 1010 kg/ha under the high emission scenario, respectively. Whereas under the low-carbon soil for the mid and late century under the high emission scenario, the yield is reduced by ~305 and 480 kg/ha relative to the baseline scenario. Under high-emission scenarios (RCP 8.5) in the later century, high SOC soils recorded a 16 % higher grain yield compared to low carbon soil for timely sown crops, with the yield advantage further increasing to 20 % in the later century (Fig. 2). Further low SOC soils displayed a significant yield gap under the baseline scenario, producing 200 kg/ha less than medium SOC soils and 1000 kg/ha less than high SOC soils under the same conditions (Fig. 2). For the Mendri variety, under high-emission scenarios (RCP 8.5), projections highlighted that high SOC soils provided a yield advantage of 417-1318 kg/ha over the baseline of this variety for the mid and late centuries (Fig. 3). In medium SOC soils, the yield advantage was 11 % and 38 % in the baseline scenario during the mid and late centuries, respectively compared to low SOC (Fig. 3). However, in low SOC soils under RCP 4.5 during the mid and late century, grain yield declined by 320-520 kg/ha compared to the baseline scenario. Under the RCP 8.5 scenario, low SOC

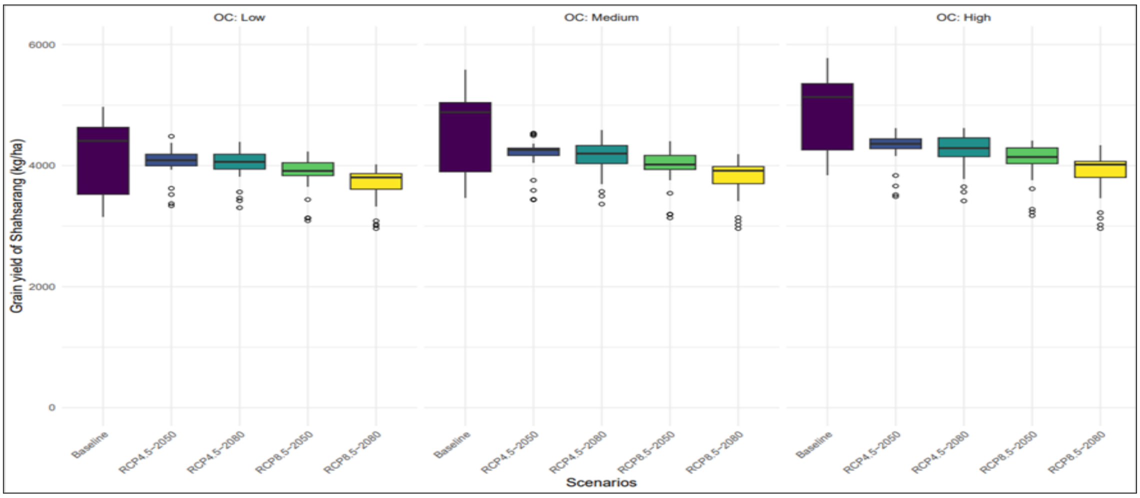

Fig 2. Long-term (30-years) simulated grain yield for Shahasarang variety across different carbon gradients under baseline and projected climate scenarios. (low (C1), medium (C2) and high (C3) SOC soils).

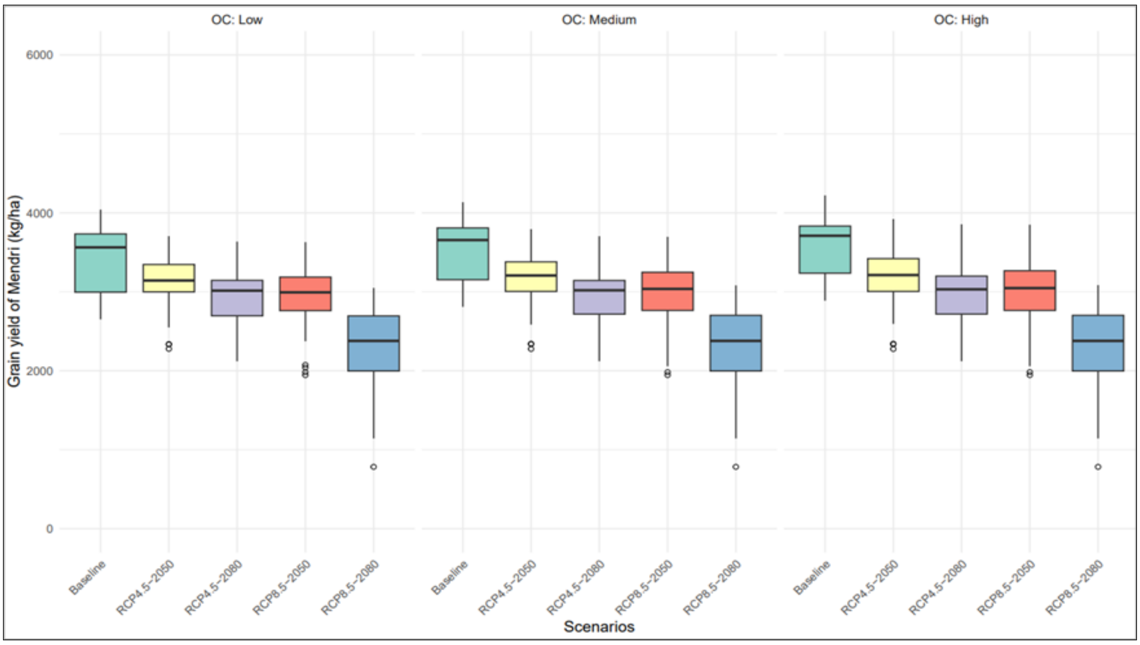

Fig 3. Long-term (30-years) simulated grain yield for Mendri variety across different carbon gradients under baseline and projected climate scenarios. (low (C1), medium (C2) and high (C3) SOC soils).

soils faced yield declines of 540 kg/ha and 1890 kg/ha during the mid and late centuries, respectively, relative to the baseline scenario (Fig. 3). Across the carbon gradients there was no prominent effect on grain yield for this variety under the baseline and future climate scenario.

In the long-term simulation considering 1991 as the base year the trend of SOC was assessed across the carbon gradients under numerous nutrient management practices was where we found that the SOC was reduced by 10.87 % in control, followed by 75 % RDN (-8 %) and 100 % RDN (-6.5 %), in a low C soil. The only scenario where SOC was increased (by 1.28 %) under a low C soil was with integrated nutrient management with 75 % RDN and 10 t/ha FYM application. However, under C2 and C3 soil, the SOC reduced in all the scenarios of nutrient management and the reduction varying from -10.97 % to -1.72 % for C2 and from -11.9 % to -5.22 % for C3 (Fig. 4). For Mendri, with the base year selected as 1991, after 33 years the resulting SOC for C1 was -10.94 % and 3.11 % for treatments S1 (without nitrogen) and S7 (75 % RDN+10 t/ha FYM), respectively. The SOC was increased by the application of 5 t/ha FYM in 75 % RDN (0.86 %) and 10 t/ha FYM in 75 % RDN (3.1 %) and 50 % RDN (2.49 %). In contrast, a different trend was identified in soil C2 and C3, where all treatments showcased a decline in SOC ranging from -10.97 % to -0.84 % for C2 and -11.17 % to -5.12 % for C3 soil over the years (Fig. 4).

Discussion

The decline in grain yield under future scenarios is primarily due to elevated temperatures and an increased frequency of extreme high-temperature events. This trend is more pronounced under higher RCPs, where intensified warming and climate extremes are projected to adversely impact crop productivity (Fig. 5) (12). This pattern accelerates the grain-filling process, which negatively impacts grain yield, as the grain-filling rate has an inverse relationship with duration (13). Consequently, whether prolonged or shortened, any alteration in the length of crop growth phases significantly affects the final yield (14). Shortened growth durations owe to climate-related yield loss worldwide, as higher temperatures accelerate crop development stages (15). The comparison between the varieties shows that the Shahsarang, shows a yield advantage under high-emission scenarios over Mendri,

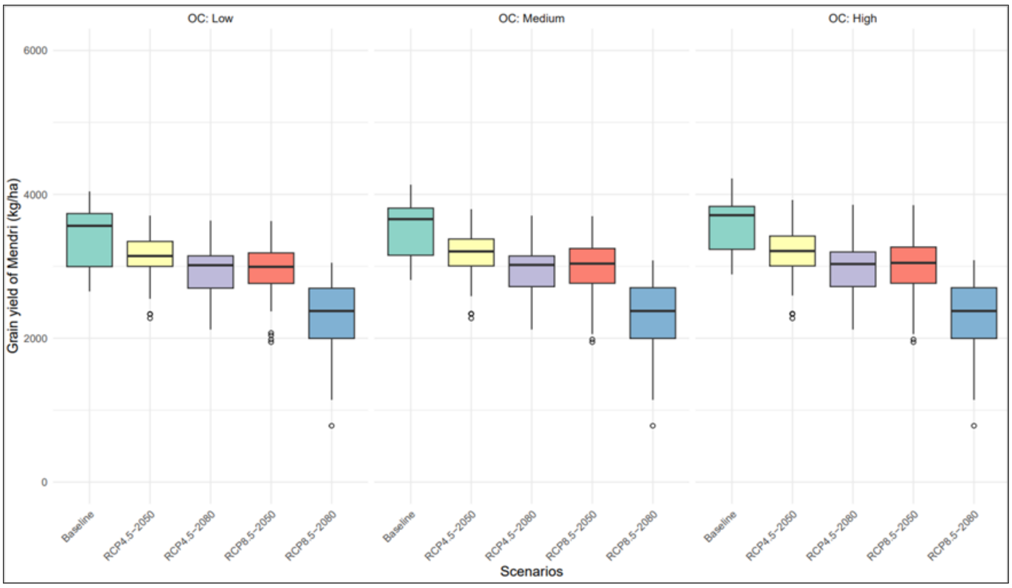

Fig 3. Long-term (30-years) simulated grain yield for Mendri variety across different carbon gradients under baseline and projected climate scenarios. (low (C1), medium (C2) and high (C3) SOC soils).

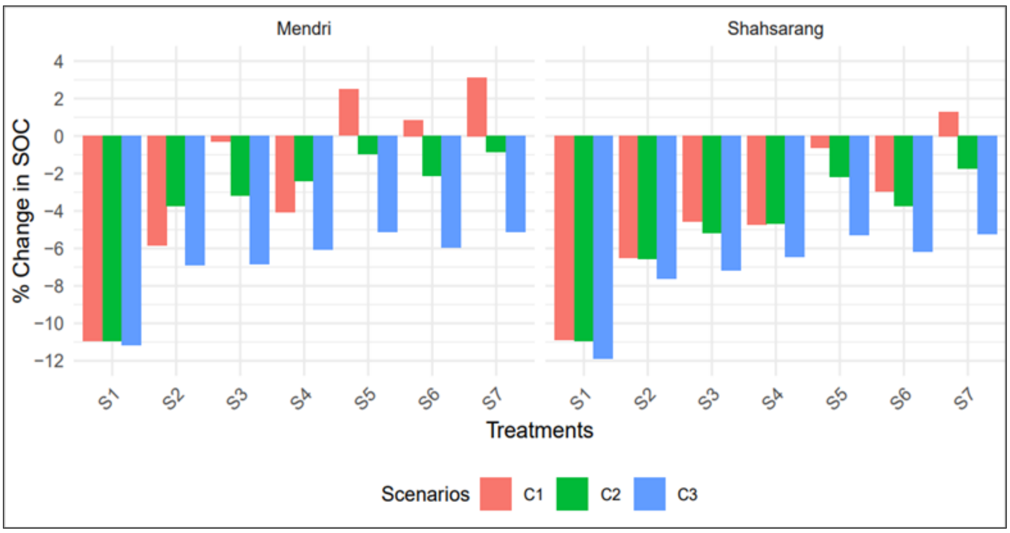

Fig 4. Changes in SOC after 33 years (base year-1991) in (low (C1), medium (C2) and high (C3) SOC soils. (The treatments illustrated as S1-Control, S2-75 % RDN, S3-100 % RDN, S4-50 % RDN + 5t/ha FYM, S5-50 % RDN 10t/ha FYM, S6-75 % RDN+ 5t/ha FYM, S7-75 % RDN 10t/ha FYM).

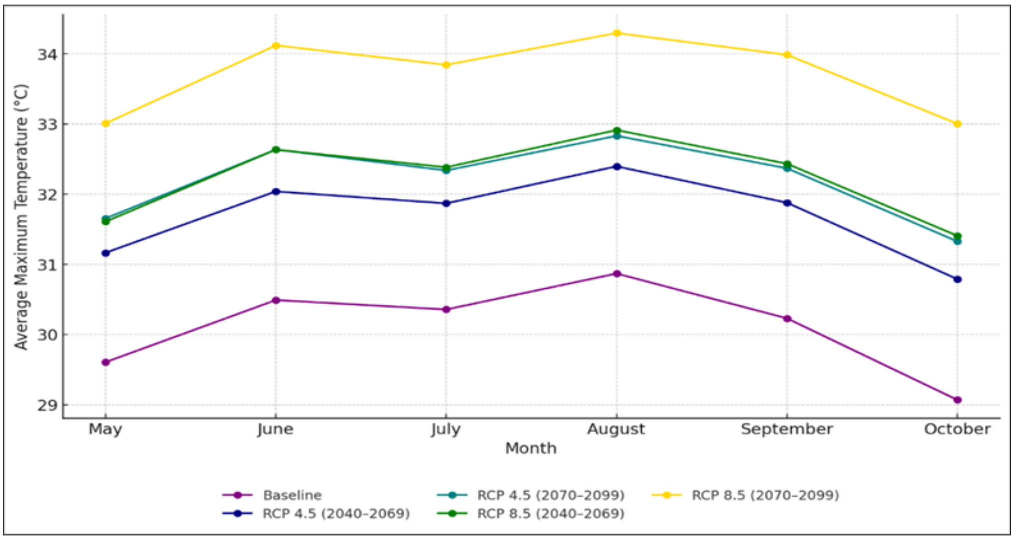

Fig. 5. Average maximum temperature from May to October across different climate scenarios: Baseline (1976-2005), RCP 4.5 (2040-2069), RCP 4.5 (2070-2099), RCP 8.5 (2040-2069) and RCP 8.5 (2070-2099).

suggesting resilience to extreme climate conditions. Also, these results highlight the consistent advantage of high SOC soils in maintaining grain yield across all scenarios, including both intermediate (RCP 4.5) and high (RCP 8.5) emissions. The resilience provided by high SOC soils become increasingly critical under future climate conditions. For the Shahsarang variety, the yield difference between the baseline scenario in low-carbon soil and the high-carbon intermediate emission scenario is significant, highlighting the critical role of healthy soils in minimizing yield loss. Previous studies have also reported a positive correlation between organic amendments in soil which increase soil SOC and crop yield (16). Additionally, it becomes evident that adopting a combination of strategies such as low-emission practices alongside improved management techniques presents a more achievable pathway to ensuring food security in the future. This integrated approach highlights the necessity of prioritizing sustainable soil management and emission reduction to support long-term agricultural productivity. Fertilization practices influence carbon sequestration pools and dynamics (17, 18). Some findings revealed that combining organic manures with NPK fertilizers significantly enhanced Total Organic Carbon (TOC) and other carbon fractions, whereas the application of NPK fertilizers alone showed no effect on TOC compared to the control. Hence, maintaining a high SOC is important for the sustainability of any production system. The repercussions of persistent suboptimal fertilizer application extend to the risk of rendering the soil infertile in the long term. Moreover, excessive fertilizer application can reduce SOC, enhance soil acidity and overall deterioration of soil health (19). A more balanced and sustainable approach emerges through the blending of manures with mineral fertilizers that positively enhance soil quality (20). Besides, the role of INM practices in maintaining the SOC is evident in NEH regions, as INM encompasses a wide spectrum of nutrient sources applied to the soil (21). In the present study C1 soil, the impact of 33-year continuous rice monocropping revealed that applying FYM @ 10 t/ha leads to SOC accumulation in 75 % RDN in Shahsarang. While in the Mendri variety, three treatments exhibited positive trends ranging from 0.86 to 2.36 %. This divergence in results may be because the former is a HYV that produces higher biomass annually. Consequently, it extracts a proportionate amount of nutrients from the soil, necessitating a higher application of externally applied fertilizer to compensate for this removal. In the case of Mendri, its low responsive nature to externally applied nutrients allowed more combinations of treatments that could sustain the SOC levels. This low-responsive nature of indigenous rice cultivars in the NEH was also highlighted in previous study (22).

Conclusion

This study outlines the impact of climate change on rice productivity and resilience in the Northeastern Hill Region of India, especially as climate variability increases. Projected changes, such as shifts in rainfall patterns and more frequent temperature extremes, show distinct responses of both rice varieties under high-emission pathways. The Shahsarang variety outperforms Mendri in future climate scenarios, with intermediate emission scenarios showing a lesser yield decline compared to high emission scenarios. Additionally, the number of heatwave events is significantly higher in the projected climate scenarios. Further, the role of INM practices in maintaining SOC highlights the significance of these measures in promoting a sustainable rice production system. Hence, there is a necessity for further adaptation strategies such as supplemental irrigation and optimum transplanting times that align with climate projections, ensuring food security and resilience against unpredictable prospects.

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Authors' contributions

SB, CMP and BUC did conceptualization. SB, CMP, SSR, TKD, RSB, SM, NB, AR, KP, KSR, BM and BUC designed the experiments. SB NB, BM and BUC contributed experimental materials. SB executed the field/lab experiments and collected the data. SB, CMP, MY, AR, KP, KSR and BUC performed data analysis and interpretation. SB, CMP, AR, KP, KSR and BUC, prepared the manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interests to declare.

Ethical issues: None

References

1. FAO, Agriculture producer price indices. FAOSTAT Analytical brief series No. 6. Rome. Agriculture Producer Price Indices. 2020.
2. US Department of Agriculture (USDA), Economic Research Service (ERS), Ag and food statistics: Charting the essentials. Farming and Farm Income. 2022. https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials
3. Mohapatra S, Tripathy SK, Mohanty AK, Tripathy S. Effect of heat stress on yield and economics of rice (*Oryza sativa L.*) cultivars under different sowing dates. J Agrometeorol. 2021;23(1):38-45. https://doi.org/10.54386/jam.v23i1.86
4. McKenzie FC, Williams J. Sustainable food production: constraints, challenges and choices by 2050. Food Sec. 2015;7:221-33. https://doi.org/10.1007/s12571-015-0441-1
5. Das PJ. Rainfall regime of northeast India: A hydrometeorological study with special emphasis on the Brahmaputra basin. Ph.D. [thesis]. Guwahati: Guwahati University. 2004.
6. Ashiq W, Nadeem M, Ali W, Zaeem M, Wu J, Galagedara L, et al. Biochar amendment mitigates greenhouse gases emission and global warming potential in dairy manure-based silage corn in boreal climate. Environ Pollut. 2020;265:114869. https://doi.org/10.1016/j.envpol.2020.114869
7. Ali W, Nadeem M, Ashiq W, Zaeem M, Gilani SSM, et al. The effects of organic and inorganic phosphorus amendments on the biochemical attributes and active microbial population of agricultural podzols following silage corn cultivation in boreal climate. Sci Rep. 2019;9:1-17. https://doi.org/10.1038/s41598-019-53906-8
8. Kumar M, Das A, Layek J, Buragohain J, Gandhiji Idapuganti R, Babu, S, et al. Impact of varieties and organic nutrient sources on productivity, soil carbon stocks and energetics of rice-ratoon system in Eastern Himalayas of India. Carbon Manag. 2021:12(2);183-99. https://doi.org/10.1080/17583004.2021.1893130
9. Keating BA, Carberry PS, Hammer GL, Probert ME, Robertson MJ. An overview of APSIM, a model designed for farming systems simulation. Eur J Agron. 2003;18(3-4):267-88. https://doi.org/10.1016/S1161-0301(02)00108-9
10. Pachauri RK, Meyer LA, editors. Climate Change 2014: Synthesis report. Contribution of working groups I, II and III to the fifth assessment report of the intergovernmental panel on climate change, 2014. Geneva, Switzerland: IPCC. 2020.
11. RCP database (version 2.0). International Institute for Applied Systems Analysis (IIASA) [Internet]. https://tntcat.iiasa.ac.at/RcpDb/dsd?Action=htmlpage&page=about#citation
12. Zandalinas SI, Fritschi FB, Mittler R, Signal transduction networks during stress combination. J Exp Bot. 2020;71:1734-41. https://doi.org/10.1093/jxb/erz486
13. Yang W, Peng S, Dionisio-Sese ML, Laza RC, Visperas RM. Grain filling duration, a crucial determinant of genotypic variation of grain yield in field-grown tropical irrigated rice. Field Crops Res. 2008;105 (3):221-27. https://doi.org/10.1016/j.fcr.2007.10.006
14. Tao F, Zhang Z, Shi W, Liu Y, Xiao D, et al. Single rice growth period was prolonged by cultivar shifts, but yield was damaged by climate change during 1981-2009 in China and late rice was just opposite. Glob Change Biol. 2013;19(10):3200-09. https://doi.org/10.1093/jxb/erz48610.1111/gcb.12250
15. Zhao J, Yang X, Dai S, Lv S, Wang J. Increased utilization of lengthening growing season and warming temperatures by adjusting sowing dates and cultivar selection for spring maize in Northeast China. Eur J Agron. 2015;67:12-19. https://doi.org/10.1016/j.eja.2015.03.006
16. Yan X, Zhou H, Zhu QH, Wang XF, Zhang YZ et al. Carbon sequestration efficiency in paddy soil and upland soil under long-term fertilization in southern China. Soil Tillage Res. 2013;130:42-51. https://doi.org/10.1016/j.still.2013.01.013
17. Yan D, Wang D, Yang L. Long-term effect of chemical fertilizer, straw and manure on labile organic matter fractions in a paddy soil. Biol Fertil Soils. 2007;44:93-101. https://doi.org/10.1007/s00374-007-0183-0
18. Yang X, Ren W, Sun B, Zhang S. Effects of contrasting soil management regimes on total and labile soil organic carbon fractions in a loess soil in China. Geoderma. 2012;177:49-56. https://doi.org/10.1016/j.geoderma.2012.01.033
19. Celik I, Gunal H, Budak M, Akpinar C. Effects of long-term organic and mineral fertilizers on bulk density and penetration resistance in semi-arid Mediterranean soil conditions. Geoderma. 2010;160 (2):236-43. https://doi.org/10.1016/j.geoderma.2010.09.028
20. Zhang A, Bian R, Pan G, Cui L, Hussain Q, et al. Effects of biochar amendment on soil quality, crop yield and greenhouse gas emissions in a Chinese rice paddy: A field study of 2 consecutive rice growing cycles. Field Crops Res. 2012;127:153-60. https://doi.org/10.1016/j.fcr.2011.11.020
21. Gogoi B, Borah N, Baishya A, Dutta S, Nath DJ, et al. Yield trends, soil carbon fractions and sequestration in a rice-rice system of Northeast India: Effect of 32 years of INM practices. Field Crops Res. 2021;272:108289. https://doi.org/10.1016/j.ecolind.2021.108262
22. Laishram J, Saxena KG, Rao KS. Rice cultivar diversity, associated indigenous knowledge and management practices in a lowland village landscape from northeastern India. Vegetos. 2020;33:172-86. https://doi.org/10.1007/s42535-020-00097-7

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