ABSTRACT

Dryland farming is highly affected by climate variability. With decreasing land holding, small and marginal farmers of dryland ecosystems continue to live below poverty line and facing significant economic and social deprivation. Hence, there is a need to investigate the role of Integrated Farming System (IFS) for improving the income of dryland farmers. Understanding the system's vulnerability makes better planning the adaptation or mitigation measures and its impact assessment is essential for policy design. Therefore, this study aimed to compare the dryland community's past and future vulnerability levels to effectively implement the IFS for their sustainable livelihood. The study involved the vulnerability index calculation with new contextual variables, future climate data extraction using regional climate models and ensembling through machine learning techniques, crop yield (sorghum, maize and pearl millet) simulation using DSSAT model, and optimization of IFS for the dryland ecosystem. The logistic regression analysis was used to extract the factors affecting the adoption of the adaptation measures. The research was carried out on smallholder dryland farmers in southern India. The results stated that the community is moderately vulnerable in the current scenario due to its higher adaptive capacity. The climate change will affect maize and sorghum crops with yield reduction of 30 to 40% during the future period (2021 to 2050) as compared to historical yield (3749 to 4146 kg/ha) of the region. The crop simulation results suggested shifting sowing time around 30 to 40 days in the future period as an adaptation to nullify the effects of climate change. The study recommended IFS, which comprises 2 ha field crops (1.6 ha of sorghum, 0.2 ha of maize and 0.2 ha of pearl millet) and 30 units livestock (2 cows, 3 buffaloes and 25 goats) for dryland small farmers to maximize the profit under climate change scenarios. The future vulnerability would be reduced due to the higher adaptive capacity of the designed IFS for the study area. The factors "farm size, livestock farming and involvement in the extension activities" significantly impacted the adoption of the IFS. The study recommends that these factors need to be considered while implementing the IFS in the study area to reduce the vulnerability level of the dryland farmers. The current study demonstrated a path that can aid policy research and development for dryland farmers' sustainable livelihood in a climate-changing scenario on a micro-level.

Keywords: Climate change, DSSAT, Dryland, Integrated farming, Machine learning, Policy research, Vulnerability index