CHAPTER VI. CONCLUSION AND SUGGESTION

A. CONCLUSION

1. The historical data in Chợ Mới District, An Giang Province, Vietnam, including various parameters, has been collected over a period of 10 years (2010 - 2019) preceding the start of the research (2020), aimed at developing a SIMPLECrop model. Furthermore, data on soil characteristics, weather conditions, crop biomass, and irrigation amount for both the Autumn-Winter season (AW) and Winter-Spring season (WS), as well as for two seasons in greenhouses, had also been collected to develop the model. The average annual temperature during 2010-2019 witnessed a rise, from 0.2 - 0.8°C. Atmospheric CO_2 concentrations also exhibited an increase, ranging from 394 ppm to 420 ppm. Rainfall was concentrated primarily during the rainy season (April - October), particularly from July to October, while solar radiation witnessed a substantial reduction during the rainy months. Both rice *(Oryza sativa)* and maize *(Zea mays)* exhibited higher grain yields in the Winter-Spring (WS) crop compared to the Autumn-Winter (AW) crop when grown under field conditions. The grain yield for rice in both AW and WS crops was recorded at 8.4 and 9.26 tons/ha, respectively. Similarly, for maize, the kernel yield in the AW and WS crops was 8.9 and 9.5 tons/ha, respectively. In the case of maize, the biomass was 7,596 kg/ha for AW and 8,100 kg/ha for WS crops when grown under field conditions. In the greenhouses, elevated temperatures resulted in a shortened growth period for rice by 2-3 days, leading to a reduction in yield ranging from 22.4% to 25.5% and a decrease in biomass by 13.5% to 29.1%. Similarly, for maize plants, excessively high temperatures also shortened the growth period by 3 days, resulting in a yield decrease ranging from 28.6% to 52.1%, and a reduction in stalk biomass ranging from 23.6% to 33.8%.

2. The simulation results yielded Nash-Sutcliffe Efficiency (NSE) values consistently greater than 0.65, indicating good agreement between model predictions and observed data. Evaluation results showed RRMSE and NSE values ranging from 4.2% to 6.3% and 0.87 to 0.93, respectively, for open field conditions. In greenhouse settings, these metrics varied from 1.4% to 15.1% for RRMSE and 0.75 to 0.89 for NSE. During the sensitivity analysis for rice and maize crops, two parameters, namely RUE and Tsum, consistently demonstrated the highest influence within the model.

3. Simulating an increase temperature for rice, simulating a 5°C temperature increase using the model resulted in a 7.2% to 7.7% reduction in straw biomass, and an 8.5% and 7.0% yield reduction in AW and WS seasons, respectively. In the case of maize, a 5°C temperature increase led to a reduction in stover biomass by 5.2% (in the AW season) to 19.3% (in the WS season) and a yield decrease of 11.3% and 27.0%, respectively. Under more severe heat stress (5°C increasing), the beneficial effects of elevated CO_2 were mitigated, and the increase in biomass and yield was reduced to approximately 3-5%.

B. SUGGESTION

Integrating 'Flexible Modules' into the SIMPLECrop model can address the variability of parameters like fertilizer levels, crop types, planting density, wind speed, humidity, gas concentrations, and elevation. Elevation influences temperature, atmospheric conditions, and crop growth, so a module allowing users to specify elevation is recommended. These modules allow adjustments to critical parameters impacting crop productivity. Additionally, developing separate "add-ins" for factors like pests, wind, and storms can enhance the model's adaptability. Activating different modules based on yield loss severity offers a more versatile tool. Collaborative efforts and data sharing among researchers, institutions, and agricultural stakeholders can enhance model development and refinement. Access to diverse data sources can further enhance simulation reliability and accuracy.