RISK EFFECTS ON OPTIMAL IRRIGATION STRATEGIES AND INVESTMENT IN IRRIGATION TECHNOLOGY FOR COTTON UNDER CLIMATE CHANGE

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Abstract

Adopting irrigation to reduce cotton yield losses during increasingly frequent drought periods with climate change is a potential risk management strategy for farmers. However, cotton farmers are concerned about whether investment in irrigation is economically feasible. This study determined whether adopting irrigation is risk efficient by assessing the impacts of climate change on cotton production. The Decision Support System for Agrotechnology Transfer crop simulation model was adapted and validated to simulate cotton yield for various irrigation strategies under two climate scenarios: historical (1990-2019) and RCP 4.5 (2021-2050). Antle's econometric approach was employed to estimate optimal irrigation timing and rate strategies while considering net returns' variance and skewness. Estimated net return responses were used to determine certainty equivalents and net present values of irrigation investment. The results showed that simulated yield matched well with observed yield. Expected net returns of cotton on high WHC soil were greater than those on low WHC soil. Optimal total water increased for more risk averse producers, meaning water was a risk-reducing input. Moreover, net present value decreased with smaller field sizes and became negative for some field size scenarios, indicating the importance of field size on the profitability of irrigation for cotton production. Overall, supplemental irrigation was more profitable with extremer weather (RCP 4.5) for cotton. However, risk efficient irrigation timing and rate were dependent on soil WHC, producer risk aversion, and climate scenarios. This study provides cotton producers with enhanced information about the effects of risk exposure on supplemental irrigation under climate change.