

## **Modeling Freeze Risk and Economic Potential of Satsuma mandarin Grown on the Northern Coastal Fringe of the Gulf of Mexico**

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Satsuma mandarins have been grown on the northern coastal fringe of the Gulf of Mexico for over 100 years. There was a thriving industry in the early 1900's, but freeze events devastated the industry. Since the 1930's, the industry has had resurgence during warm periods only to be devastated again by freeze events. Modern protection measures developed during the 1960's reduce freeze risk, but it has not been known if these measures could make the industry economically viable. To determine its economic viability, we developed a mathematical model to predict freeze risk from 1948-2002 for unprotected trees using recorded temperature data. We estimated modification of the risk using modern freeze protection measures such as within tree microsprinkler irrigation and high-tunnel plastic houses, and hypothetical improvement in freeze tolerance of genetically modified plants. An economic analysis was conducted to determine net returns for groves under various freeze protection measures. A breakeven price for fruit was determined for each freeze protection method and compared to the break-even price to current market prices of fruit from unprotected trees. Based on these analyses, freeze protection using within-tree microsprinkler irrigation was determined to be economically viable and provided the highest net returns at current market prices. We then determined the effect of multi-peril crop insurance and freeze protection with microsprinkler on discounted net returns. Considering that the freeze risk and economic models in these studies were based on historical events, research is needed to determine economic viability with climate models that predict future temperatures and freeze events.

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