Non-Invasive Monitoring of Bee Health and Honey Production and Impact of Inclement Weather

Hayar, Tony (School: Little Rock Central High School)

Bees pollinate the flowers of many fruit trees which produce a significant proportion of our food supply. It is therefore important to improve beekeeping practices to produce healthier bees that are more effective pollinators. I hypothesize that strong storms and/or extreme temperatures could negatively impact beehive health conditions, which can be evaluated by the amount of honey production. I used two beehives had bees, and a third one that had no bees and served as a control. The weights of the beehives were monitored by placing them on different digital scales. The temperature and humidity were continuously monitored using sensors placed inside and outside the beehives. Data was collected for about 6 months starting May 19, 2025. There were periods of nectar flow (in spring and early fall) as well as periods of dearth (hot summer and fallwinter transition). During spring, the weight of the beehive at sunset increased by almost 1 kg since the bees went out foraging at sunrise. In contrast, the beehive weight surprisingly decreased ($p < 0.01$, t-test) after sunset even though the bees stayed in the beehive at night. This can be attributed in part to the evaporation of the water in the nectar. There was significant disruption in bee productivity especially after heavy rains. In conclusion, measuring beehive weight, temperature, and humidity provides critical insights into the bee colony's health, activity, and productivity without requiring disruptive manual inspections. These parameters allow beekeepers to detect beehive problems early on to intervene effectively and prevent the possibility of Colony Collapse Disorder which could reduce crop production and lead to global food insecurity.

Awards Won:
Missouri University of Science and Technology: Summer Camp scholarships (camp tuition and travel expenses, valued at up to $1,500)