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Hen Behavior Tracked with RFID at University of Georgia

- **University of Georgia's poultry science researchers find RFID can capture and categorize chicken activity with at least 87 percent accuracy.**

- **The data from the RFID technology study finds activity levels of chickens have some effect on health, while more research is pending.**

While RFID technology is commonly used to identify and manage cattle, as well as some sheep and pigs, tracking chickens has been more challenging. Chickens are smaller, lower value, and reared in significantly higher numbers than larger livestock.

However, academic research is finding benefits for RFID in managing the movement of hens to understand their behavior and thereby improve their health and productivity.

Over the past year, academic research led by the University of Georgia's Department of Poultry Science—in collaboration with Michigan State University and Purdue University—has found that the activity of cage-free laying hens can be tracked with RFID technology at an accuracy rate of at least 87 percent. The RFID read data that resulted from a project conducted at aviaries on campus, in 2021 and 2022, identified when birds entered and left specific tiers within their hen house or aviary.

The research team reviewed the results of the project over the past year, and next hopes to further study whether that data can be used to identify how hen activity affects health and egg productivity in individual birds.

Study from 2021

The initial RFID project was funded in 2021 by the U.S. Poultry and Egg Association and consisted of UHF RFID reader antennas installed at three different levels, in four aviaries, and metal RFID-enabled bands around the ankle of 40 birds in each of four rooms used in the study.

A total of 120 of those 160 tagged-birds were tracked with RFID across the period of the experiment with high accuracy, said Prafulla Regmi, UGA's assistant professor, Department of

Poultry Science.

The researchers classified hens based on the RFID tag reads as low-, medium- or high-activity birds, based on how often they entered and left each tier. It also found that less-active, cage-free layers, who typically spent more time in the lower tier of the house, tended to have fewer keel bone fractures when compared to the medium or high active hens in the same house.

Cagefree Laying Hen Health and Behavior

There are about 379 million layer hens, according to the World Animal Foundation—about 35 percent of them are living in cage-free environments. Typically, these commercial hens begin laying eggs at 18 to 20 weeks of age and are kept in production until they reach 72 weeks of age.

Over the past seven years, egg producers have been transitioning from cage confinement to cage-free systems for chickens. In commercial aviary systems, hens do not have access to the outside—as opposed to free range chickens—but they are able to walk about within their aviary, spread their wings and lay their eggs in nests (all of which is limited when confined in cages).

These cage-free aviaries are multi-tiered houses including a floor area with a substrate such as wood shavings or straw that promotes foraging, scratching and dust bathing behaviors, explained Regmi. They also have a dedicated nest area for egg laying.

However, because chickens share a larger space, the cage-free environment introduces some other welfare problems such as pecking between birds, and high incidences of keel bone fractures can occur when aviaries are poorly designed or managed.

Another challenge related to cage-free units is ensuring hens

lay their eggs in nests as opposed to on the floor where the eggs can get stepped on or eaten. "You essentially want the birds to lay the egg in the nest box, because if the egg is laid on the floor," Regmi says, they may or may not be sellable.

Technology Options to Track Birds

But for egg producers, it's challenging to track the birds' movement throughout the hen house. One technology option for tracking chicken activity is videography, but once birds enter the aviary system they can easily disappear from view of the lens throughout the tiers and corners of the housing system.

Additionally, videography cannot easily or automatically identify specific birds. Infrared technology faces similar challenges, and Bluetooth based systems could be costly and require batteries that would be cumbersome for the birds.

As a result, the researchers' funding was aimed at tracking the movement of birds with passive UHF RFID tags attached to their legs and the data then validated the accuracy against videos.

Confirming RFID Technology Effectiveness

The project at Michigan State University was initially focused specifically on testing whether RFID could be an effective tracking mechanism for chickens at all, said Regmi.

The group installed a traveling wave antenna along the entrance of each tier to capture RFID tag reads when the bird came and went, detecting in which direction they were moving. The hens were then tracked for about 12 weeks. The data could not be analyzed however, until the end of the birds' lives at which time the RFID tag data was compared against fracture rates.

"Initially we were just trying to validate RFID technology," Regmi said. So the team also applied color leg bands on the

RFID-tagged birds, and then mounted cameras at different tiers to analyze whether the RFID tag reads matched with the activity captured on video.

Matching Video Against RFID

The RFID tag was attached via a metal leg band using a heat activated shrink wrap to secure the RFID tag to the band. The RFID tag the researchers selected was designed for medical purposes to tag surgical equipment, therefore it was small and could withstand the heat of autoclaving (similar to heat needed to attach to the metal leg band.)

“We lost a few tags—either the bird got their leg band off or some of the heat shrink wrapped didn’t work well,” Regmi said. “But out of 160 birds we were able to get a complete data set for 120 birds.”

The results found an 87 percent RFID read-accuracy based on correlations with video results. But Regmi speculated that the accuracy may have been higher than that, because the video recording didn’t always find the bird within its field of view, even as the RFID system was detecting its tag.

Finding Activity Classifications

Thus far, by examining the hens after they were killed, researchers found bone fracture prevalence among the most highly active hens, while low activity birds had either no fracture or had a less severe fractures.

When it came to activity levels, “there were some birds that would go up and down the system throughout the day, they will have more than 20 transitions throughout the tiers,” Regmi said. “There were some individual variations from day one, to day two, and so on, but more or less the activity level remained the same.”

“So what we then tried to do was determine what this means for the biological functioning of the birds—can we get some idea

on their welfare and how many eggs they produce?”

Future Goals Around Activity and Laying Correlations

Assessing when hens are laying eggs is a challenge. However, Regmi said the research team is seeking a company that makes RFID reader and antennas that could be installed underneath the nest box, “and then we can probably tell if the bird was in the nest box and if the bird laid an egg.”

Producers may also want to determine if RFID can detect or help prevent cases in which certain birds lay eggs on the floor and try to minimize the rate of that activity.

The researchers have been presenting their initial findings at industry related workshops such as poultry science associations meetings. The next project may probe what can be learned about the activity and the resulting productivity of the bird, or whether some birds are aggressive toward others.

Research Ahead at North Carolina

Future studies may take place at aviaries in North Carolina State University. Other studies have included work conducted in China. And a large scale project led by Michael J Toscano at the University of Bern Switzerland associated behavior within a flock of chickens with RFID or other similar technologies.

One challenge for RFID technology use in the poultry industry could be cost, says Regmi. Readers, antennas and even the tags themselves can be costly when considering that the chickens are comparatively low value (approximately \$20).

“RFID is not cheap enough yet, to be utilized in commercial layer farms,” he said, however the tags could be used for designated birds within a flock to reduce the need to tag every individual hen.

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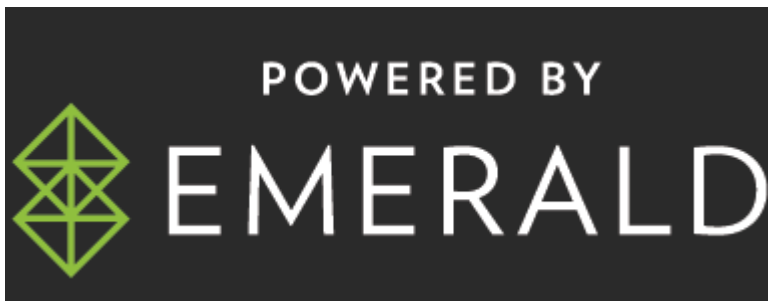
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