



Advancing Genomic-Enabled Newcastle Disease Resistance in Chicken

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Newcastle disease (ND) is one of the most devastating poultry diseases worldwide with mortality rates of up to 90% in some flocks. Vaccines exist but vaccine access and effective delivery particularly to remote rural areas is challenging. Genetic selection for enhanced resistance to the ND virus offers a promising complementary approach to vaccination and improved biosecurity in village production systems.

Differences in disease resistance between chickens are, in part, genetically controlled. This allows for genetic improvement of targeted traits specifically innate resistance to the virus and efficacy of host immune response to ND vaccination.

Purpose

The purpose of the “Advancing Genomic-Enabled Newcastle Disease Resistance in Chickens” under the Feed the Future Innovation Lab for Livestock Systems is to increase the productivity and enhance Newcastle Disease resistance of indigenous poultry breeds in Ghana and Tanzania through genetic improvement, business planning, and capacity strengthening of poultry value chain actors.

Objectives

- Enhance Newcastle disease resistance in indigenous chickens using genomic selection breeding techniques.
- Create an inclusive business plan to market and distribute the Newcastle disease resistant poultry products to local smallholder farmers in sub-Saharan Africa.
- Strengthen the capacity of local research institutions, community animal health workers, poultry breeders, smallholder poultry farmers, and others in the poultry sector to continue genomic selection research, breeding, and caretaking of improved poultry stock.

Principal Investigator

- Geoffrey E. Dahl, University of Florida

Organizations

- University of California Davis
- University of Ghana
- Sokoine University of Agriculture
- University of Florida

Background

In Ghana, 4.8 million of the 13 million total poultry population, are local chickens. According to an estimate from the Ministry of Food and Agriculture Veterinary Services Directorate in Ghana, up to 10 million local chickens will be lost due to ND outbreak annually, which results in an estimated economic loss between \$20 and 40 million. In Tanzania, about 38 million indigenous chickens are raised in households or by smallholder farmers.

ND is a highly contagious and often highly virulent ND strains (mesogenic and velogenic) affecting domestic poultry worldwide. The control of ND in village or backyard flocks remains challenging due to the specific problems associated with vaccinating multi-age flocks such as the absence of a viable cold chain to support the distribution of vaccines. As this is a global problem, a paradigm shift is needed to breed birds that are more resistant to the disease, moving away from the need for vaccination or at least less frequent vaccination against ND.

Approach

The project aims to enhance ND resistance in indigenous chickens using a genomic selection platform developed as part of the Genomics to Improve Poultry Innovation Lab that ended in 2023. The project will use this existing genomic selection platform to selectively breed indigenous chickens primarily focusing on males to improve survival time in the face of infection with the velogenic ND virus. In order to achieve marketable chickens with enhanced ND resistance and moderate egg production and growth performance, new generations of selectively bred males against ND infection in Ghana and Tanzania will be generated through 3-5 hatches depending on the flocks' egg production rate and fertility. A hybrid model will be employed by utilizing indigenous birds that are genetically improved for survival time as a sire and using dual-purpose birds as a dam to take advantage of the hybrid offspring's good performance in both egg production and growth rate as well as more hardiness in the local environment. This will be followed by rigorous data analysis to inform revisions of the genomic selection platform and future rounds of selective breeding until a productive chicken with enhanced ND virus resistance is obtained.

From the beginning, the project will engage with local actors and collect substantial quantitative and qualitative data to inform the development of inclusive business plans. The project will employ a system-wide approach for local capacity development to engage relevant value chain actors, private sector, local government and community stakeholders, and policymakers, thereby supporting and sustaining system changes in the poultry research and scaling ecosystem. It will also ensure the capacities are there to scale chicken production with enhanced ND resistance and create an inclusive and enabling business plan.

Additional Collaborators and Partners

- Iowa State University
- Hendrix Genetics
- World Poultry Foundation

Project Website [Link](#)

<https://livestocklab.ifas.ufl.edu>
www.feedthefuture.gov