Working Group Recommended Novel Tools and Technology for HPAI Prevention

NTT Novel Tools and Technology Guide

Purpose

The BC poultry industry, allied trades, BC research universities, and Provincial government convened the BC Avian Influenza Novel Tools and Technology Working Group (NTT WG) over the spring and summer of 2025, as a coordinating group for evaluating, planning implementation, and monitoring effectiveness of new tools and technologies that may further reduce risk of High Pathogenicity Avian Influenza (HPAI) infection of commercial poultry flocks.

This document outlines a list of technologies that have been identified as targets for further research under Stream 2 of the Investment Agriculture Foundation (IAF) Novel Tools and Technology for HPAI Prevention Pilot. The recommended list is derived from a larger list of novel tools and technology identified by a Simon Fraser University Knowledge Link (SFU-KL) literature review, and then further evaluated by the NTT WG and the BC Ministry of Agriculture and Food Office of the Chief Veterinarian staff. The Report by SFU-KL can be provided to Stream 2 Applicants on request to ntt@iafbc.ca, and contains the full list of novel tools and technology identified by SFU-RSO, along with information sources and citations.

The recommended novel tools and technology list for Stream 2 is divided into two categories. Category 1 includes tools and technologies that are eligible for Stream 1 of the NTT program and are being implemented by producers on commercial poultry farms in the Fraser Valley this fall. Category 2 includes emerging novel tools and technology that require further research via laboratory or small-scale confined field pilots to determine whether they may be of value for on-farm use. Each category list is in alphabetical order and is not ranked or prioritized.

Category 1: Eligible for Stream 1 of the Novel Tools and Technology for HPAI Prevention Program

These tools and technologies are eligible for Stream 1 funding under the NTT Funding Program administered by the IAF, so they are expected to be deployed on up to 75 commercial poultry farms in the Fraser Valley this fall. Research proposals that will further assess the efficacy and practicality of these tools and technologies, both in laboratory settings and using data collected from farms participating in Stream 1, are invited to apply for Stream 2 funding. Further details about these eligible novel tools and technologies can be found in the NTT Program Guide or online at iafbc.ca/ntt.

Tool/Technology	Description
Mechanical Air Filtration	Particulate filters like HEPA and MERV 16 or higher are commonly used to capture particles. Successfully implemented in swine operations to prevent PRRSV transmission.
Electrostatic precipitators (ESPs)	ESPs work by charging aerosol particles and collecting them on electrodes. Laboratory studies have demonstrated high efficiency in removing airborne viral RNA and collecting virus-laden particles.
Positive pressure upgrade	Positive pressure ventilation systems use fans to pull air into the barn, creating a positive pressure environment that can be filtered, and push air out of the barn, preventing the influx of non-filtered air.
Ultraviolet (UV) light	UV light, particularly UV-C, is used to inactivate airborne pathogens by damaging their DNA. Studies show effective inactivation of various viruses and bacteria in labs.

Category 2: Emerging Novel Tools and Technologies for HPAI Prevention

This category includes early emerging novel tools and technologies that require further research via laboratory or small-scale confined field pilots to determine whether they may be of value for on-farm use. It is expected that some may be determined to be of potential utility, while others will turn out not to be of value. Because Category 2 novel tools and technologies are at an early emerging stage, they are not eligible for Stream 1 NTT Program funding.

Category	Tool/Technology	Summary
Air Management	Acidic electrolyzed water	Acidic electrolyzed water is a stable, antimicrobial solution produced by electrolysis of salt water, effective against a broad range of microbes, including avian influenza viruses. It significantly reduces airborne microbes and can be produced on-site cheaply and safely. Academic research in livestock and poultry settings is limited.
	Antiviral Paint	Recent research from Dr. Faizal Careem's team at the University of Calgary aims to use antiviral paint, containing titanium dioxide, combined with UV light, as a novel tool against HPAI. In theory, viruses that make contact with treated walls would be inactivated, thereby reducing the risk of transmission to poultry within a barn setting. This preliminary research is unpublished.
	Disinfectant fogging	A 2005 study indicated that spraying or fogging broiler chickens with 1% disinfection solution had no adverse effects on the birds; however, this is an off-label use and requires further study to understand animal welfare impacts and withdrawal times.
	Electric field entrapment	Electric field entrapment uses charged electrodes to attract dust and microbes, sometimes combined with disinfectants for faster pathogen inactivation. It appears more effective in broiler barns than layer barns due to metal interference. Although studied for airborne bacteria in industrial settings, it hasn't been tested in poultry environments or against influenza viruses.
	Electrostatic Spray Scrubber	Electrostatic spray scrubbers use charged water droplets to remove dust and microbes from the air, potentially reducing HPAI risk by limiting dust-based

		transmission. While ESS has been shown to remove bacteria in poultry houses, it hasn't been tested specifically against viruses like HPAI, and only one study has been conducted so far.
	Ionization-based systems	Ionization-based systems enhance particle capture by using ionizers to release negatively charged ions, improving filtration efficiency. They've shown promise in reducing airborne dust and viruses, including influenza, but studies have mostly been small-scale and laboratory based.
	Microwave irradiation	A recent study suggests that microwave irradiation successfully inactivates aerosolized influenza virus. Inactivation was time-dependent, with five minutes of irradiation reducing viral load by 94%.
	Nanoparticles	Nanoparticles (1–100 nm) show potential for enhancing air filtration by removing microbes. Lab studies have demonstrated that nanosilver/TiO_2-chitosan and copper nanoparticles can eliminate up to 97–99% of viral and bacterial particles. Plant-based nanoparticles also showed antibacterial effects, though not tested on viruses. These technologies are still experimental, not commercially available..
	Non-Thermal Plasma (NTP)	Non-thermal plasmas (NTPs) use ionized gases to inactivate airborne pathogens and have shown promise in lab tests, including against viruses like PRRSV. However, field results—such as in a U.S. pig barn—have been inconsistent, with humidity affecting performance. NTPs haven't been tested in poultry settings.
	Photocatalytic oxidation	Photocatalytic oxidation uses UV light and materials like titanium dioxide to generate reactive oxygen species that break down pollutants and microbes, including viruses. While mainly studied for food and water sanitation, it's now being explored for air filtration. However, data is limited, and effectiveness can vary with temperature, humidity, and airflow, which are key factors in agricultural settings.
	Portable air cleaning devices	Portable air purifiers with high-efficiency filters can remove airborne viruses faster than HVAC systems alone and have been effective in various community settings. While dust levels should be considered in poultry environments, their low cost, availability, and safety may make them suitable for use in ante rooms or areas outside restricted zones on farms.

Waterfowl Management	Automated wildlife detection systems	Wildlife deterrents work best when based on animal movement and behavior patterns. Automated detection systems use cameras and machine learning to monitor wildlife visits and identify species accurately. These systems have been applied in forests, human settlements, farms, and specifically on poultry farms to detect wild birds and help prevent avian influenza. Further research is needed to link detection with effective mitigation.
	California Waterfowl Tracker	The California Waterfowl Tracker (CWT) is a web app that monitors wild waterfowl locations and numbers in near real-time. Researchers used CWT data, climate info, and satellite imagery to map waterfowl proximity to poultry farms, identifying when and where HPAI risk is highest—particularly during population peaks in January and February. Further research is needed into whether this model could be adapted for other regions.
	Habitat Modification	Alterations to landscape features near poultry barns, such as the addition of features like hedging, fencing, or walls to alter wind or air currents, or rain runoff or splatter. Epidemiological studies found that H5N1 outbreaks in China between 2004 and 2017 were linked to unprotected waterfowl habitats and rice paddies, while proximity to protected wetlands reduced outbreak risk. Protecting wetlands may help limit HPAI spread by offering a safe refuge for wild birds and may make this a feasible and scalable strategy that aligns with environmental conservation efforts. Landscape features like waterbodies and food sources on poultry farms may attract wild birds to poultry farms. Removing these "surrogate habitats" (e.g., standing water, attractant crops) may be a long-term but feasible strategy to reduce bird presence and support disease prevention.
	Predator vocalizations	Auditory signals, like predator calls, are used to deter pests such as wild birds. A study showed varying success in deterring Red-winged Blackbirds, influenced by species and breeding season. Research into efficacy on poultry farms and impacts on neighbouring properties and operations requires further investigation.
	Red (15 Hz) flickering light	Poultry and humans react negatively to red flickering light, which in humans can cause symptoms like headaches and nausea or even seizures. A study used red flickering light at 15 Hz to successfully deter crows from certain areas. Though only one study exists, this low-cost, accessible method using battery-operated flashlights could be a

		practical tool for wild bird management, provided human health effects can be managed safely.
	Unmanned aerial vehicles (UAVs) for wildlife detection	Unmanned aerial vehicles (UAVs or drones) are used to monitor wildlife over large areas and, combined with machine learning, can accurately identify animal species from the air. Unlike stationary systems, UAVs offer broader coverage and dynamic data but face limitations like airspace regulations. Their value in tracking wild birds related to HPAI is still untested, making them an emerging tool in this field.