Boehringer Ingelheim

BTV: Navigating the Outbreaks in Europe

Proceeding of the BTV Symposium organized by Boehringer-Ingelheim in Lyon 05th November 2024

1. Introduction

The **2024 Symposium on Bluetongue Virus (BTV): «Navigating the Outbreak in Europe»**, organized by Boehringer Ingelheim, hosted in Lyon, brought together veterinarians and researchers during one full day to address the pressing challenges posed by BTV across the continent. This event provided a platform for examining the evolving landscape of BTV outbreaks, sharing regional insights, and exploring innovative solutions.

Key topics included updates from affected countries, discussions on vaccination campaigns and interspecies transmission dynamics, and projections for the virus' behavior in 2025. Expert panels and roundtables fostered collaboration on strategies to enhance diagnostic capabilities and implement effective sanitary policies. This synthesis highlights the critical findings and strategic recommendations from the symposium, underscoring the collective effort needed to mitigate the impact of BTV.

The agenda and the list of speakers are provided in Annex 1.

Country presentations are provided in Annex 2.

2. Symposium's opening
by Gerald Behrens

Gerald Behrens, leading the Strategic Marketing Group for Veterinary Public Health and the Ruminant Strategic Marketing Group at Ingelheim, opened the symposium by welcoming participants and emphasizing the importance of collaboration. He highlighted the dual purpose of the event: to reflect on lessons from past BTV outbreaks and to anticipate challenges for the upcoming seasons.

Drawing on the historical significance of Lyon as a hub for veterinary public health—rooted in the Mérieux family's pioneering work on vaccines—Behrens stressed the relevance of this location for the symposium. He also discussed the company's extensive experience with BTV over the past 25 years, noting their work on six strains, including the recent BTV-3, which had distinct characteristics compared to previous strains.

Gerald Behrens emphasized the critical importance of **outbreak preparedness**, underlining the necessity of both powerful vaccines and sufficient production capacity. He cited the company's success in addressing the BTV-3 outbreak in 2023, which unexpectedly emerged in the Netherlands. Thanks to its advanced preparation, it had a potent master seed and production volumes ready, ensuring uninterrupted BTV-3 vaccine availability.

Concluding, he invited participants to share their insights and focus on shaping strategies for the future, framing the symposium as a platform for collaborative learning and action.

3. Retrospective 2023-2024 BTV-3: drawing a parallel with BTV-8

The session lead by Guillaume Convert & Katrien Van Den Brink highlighted the outbreak of Bluetongue Virus serotype 3 (BTV-3) from 2023 to 2024, drawing comparisons to the historical spread of BTV-8 in Europe.

Guillaume Convert
VPH Technical Director India & LATAM
Boehringer Ingelheim AH France

Guillaume Convert provided historical context for Bluetongue Virus (BTV) in Europe and compared the dynamics of BTV-8 and BTV-3 outbreaks.

1. Historical Context:

- BTV was introduced to Europe in 1988, with recurring waves facilitated by Culicoides midge vectors.
- BTV-8 emerged in the Netherlands in 2006 during an unusually hot summer, spreading slowly (15 km/week) across Europe over four years. Vaccines introduced in 2008 helped control the outbreak, but it mysteriously reappeared in 2015.

2. BTV-3 Comparison:

- In contrast to BTV-8, BTV-3 spread rapidly across Europe in just one year (25 km/week). This faster transmission may be linked to changes in vector dynamics or climate conditions.
- Questions remain about the origin of BTV-3, with no clear consensus on whether wildlife reservoirs, frozen biological materials, or other factors contributed.

3. Vaccines:

- A BTV-3 vaccine strain developed earlier using a sample from La Réunion proved pivotal in responding to the 2023-2024 outbreak.

Katrien Van Den Brink
Cattle veterinarian infectious diseases - Dairy specialist
Royal GD Animal Health

Katrien Van Den Brink detailed the outbreak dynamics in the Netherlands, emphasizing the severity and impact of BTV-3 on livestock.

1. Detection and Spread:

- First detected in September 2023 through Royal GD's surveillance system. By 2024, nearly the entire Netherlands and much of Europe were affected, with over 10,000 confirmed cases, including a new serotype (BTV-12).

2. Clinical Impact:

- **Sheep:** Severe symptoms, including lameness and lesions, led to a 75% mortality rate. Surviving sheep often required euthanasia due to long-term health issues.
- **Cattle:** Milk production dropped dramatically (up to 40 liters/day), with prolonged recovery times and significant economic losses.
- **Other Species:** Cases were also reported in goats, alpacas, and dogs.

3. Prevalence and Economic Impact:

- Animal-level prevalence was 23% in cattle and 10% in sheep. The lower prevalence in sheep reflected high mortality rates.
- Economic losses were significant, with milk production impacts lasting up to 10 weeks (1.15 kg/cow/day).

4. Challenges:

- The rapid spread raised concerns about vector behavior, and questions about vertical transmission in Culicoides midges remain unresolved.

Key Takeaways

The session highlighted the need for a multifaceted response to the challenges posed by BTV-3, including:

- Improved vaccine deployment and vector control strategies.
- Ongoing research into the virus's origins, transmission dynamics, and environmental drivers.
- Collaborative efforts to mitigate economic and social impacts on livestock industries.

4. Countries review
(country presentations are provided in Annex 2)

Katrien Van Den Brink
Cattle veterinarian infectious diseases – Dairy specialist
Royal GD Animal Health

Netherlands

The Netherlands has been at the forefront of combating BTV outbreaks, with BTV-3 first detected in September 2023. This outbreak revealed the country's preparedness strengths, including an early warning system and robust diagnostic capabilities, led by the National Reference Laboratory. However, the disease spread extensively, with over 10,000 clinical suspicions reported by 2024. The unexpected emergence of BTV-12 added complexity to the outbreak management, as retrospective studies identified previously unnoticed cases. Although initial control measures included a 72-hour trading standstill, the spread underscored the challenges of containing a fast-moving vector-borne disease. Vaccination campaigns targeted sheep, rare breeds, and later cattle, but high costs borne by farmers limited coverage. The country suffered significant livestock losses, particularly among sheep, and faced challenges in maintaining adequate vaccine supply and ensuring compliance among farmers.

- **Outbreak Data:** First cases detected in September 2023; over 10,000 clinical suspicions reported by October 2024.
- **Economic Impact:** Estimated loss of 60,000 livestock in 2023; economic costs remain unquantified.
- **Control Measures:** 72-hour trading standstill; vaccination campaigns with three available vaccines.
- **Surveillance:** Early warning system enabled timely diagnostics; BTV-12 identified through field vigilance and retrospective studies.
- **Challenges:** Underreporting and no farmer compensation limited the response to the outbreak.

Ilse De Leeuw
Expert NRL Bluetongue Belgium
Sciensano

Belgium

Belgium was one of the first countries to detect BTV-3 in late 2023, following its spread from neighboring Netherlands. Initial outbreaks near Antwerp quickly expanded, leading to widespread infection across the country in 2024. The disease significantly impacted livestock health, with a sharp rise in sheep mortality (191% higher than previous years) and notable outbreaks among cattle. The lack of movement restrictions allowed the virus to spread freely, while voluntary vaccination campaigns had limited success. Farmers were left to shoulder the costs of vaccination, further discouraging uptake. The overwhelmed carcass collection system and restrictions on trade highlighted the logistical and economic challenges of managing such outbreaks. To mitigate future risks, Belgium plans to make vaccination mandatory in 2025, supported by improved coordination among stakeholders.

- **Outbreak Data:** BTV-3 first detected in October 2023; over 250 outbreaks in cattle and 1,000 in sheep in 2024.
- **Economic Impact:** Sheep mortality increased by 191%; economic costs remain unclear.
- **Control Measures:** No trade restrictions; voluntary vaccination with low uptake.
- **Surveillance:** Outbreak progression monitored through extensive diagnostic efforts.
- **Challenges:** Delayed carcass collection; trade restrictions impacted the livestock sector.

Martin Beer
Head of Institute and Vice-president
Friedrich-Loeffler-Institut (FLI)

Germany

Germany faced one of the largest outbreaks of BTV-3 in Europe in 2024, with over 13,000 reported cases. The outbreak spread rapidly across the country, facilitated by the absence of movement restrictions or zoning. However, Germany demonstrated remarkable preparedness through its Culicoides monitoring program, which provided early warnings of the outbreak. Vaccination campaigns were extensive, with over 1 million sheep and 2 million cattle immunized, but variability in vaccine efficacy raised concerns. Excess mortality data from carcass removal services revealed significant losses, especially among sheep. Despite these efforts, gaps in documenting economic impacts and production losses, such as decreased milk yields, remain a challenge. Germany's decentralized diagnostic system ensured rapid testing, but coordination across regions highlighted the complexities of a federal response to a nationwide crisis.

- **Outbreak Data:** Over 13,000 outbreaks reported by 2024; rapid spread without zoning.
- **Economic Impact:** Significant livestock losses; excess mortality tracked through carcass removal facilities.
- **Control Measures:** Movement of animals allowed; widespread vaccination for sheep and cattle.
- **Surveillance:** Extensive vector monitoring and diagnostic testing.
- **Challenges:** Vaccine efficacy concerns; unclear data on economic losses.

Stéphan Zientara
Director of the Animal Health Laboratory
National Agency for Food, Environmental and Occupational Health and Safety (ANSES)

France

France's BTV-3 outbreak began in August 2024, quickly spreading from initial detections near the Belgian border to most regions of the country by October. France responded with movement restrictions and large-scale vaccination campaigns, purchasing over 11 million doses. However, logistical issues, including delays in vaccine distribution, frustrated farmers and hampered rapid response. While estimated livestock losses were around 3%, the economic impact has not been well-documented. The outbreak highlighted gaps in France's preparedness, particularly in coordinating vaccine supply with demand. Farmers expressed dissatisfaction with the government's handling of the situation, though widespread testing and diagnostics through regional laboratories ensured reliable case confirmation. As outbreaks continued, the government expanded vaccination zones to address the rising need for preventive measures.

- **Outbreak Data:** Over 7,000 cases reported by October 2024; widespread across northern and southwestern regions.
- **Economic Impact:** Estimated 3% losses in cattle and sheep; detailed economic data lacking.
- **Control Measures:** Movement restrictions; 11 million vaccine doses procured.
- **Surveillance:** Regional labs conducted widespread PCR diagnostics.
- **Challenges:** Vaccine distribution delays and resistance from farmers hindered control measures.

Ida Tingman Moller
Senior Consultant DVM
Danish Agriculture & Food Council (L&F)

Signe Balslev
Veterinarian
Danish Veterinary and Food Administration (FVST)

Denmark

Denmark's BTV-3 outbreak was first detected in August 2024 and rapidly spread across the country, with over 800 outbreaks reported by late 2024. Initial movement restrictions were lifted after the country lost its disease-free status in September 2024, which allowed the virus to continue spreading at the same rate. Voluntary vaccination was introduced, but uptake was low due to high costs borne entirely by farmers. Estimated economic losses from the outbreak could exceed €100 million, though detailed assessments are pending. Despite challenges, Danish farmers showed strong compliance with reporting requirements, and ongoing stakeholder meetings ensured transparency. The absence of government compensation and reliance on private insurance created financial strain on affected farmers. Surveys are ongoing to understand the low vaccination rates and refine future outbreak management strategies.

- **Outbreak Data:** Over 800 outbreaks by November 2024; disease spread across the country.
- **Economic Impact:** Potential losses up to €100 million; mortality data incomplete.
- **Control Measures:** Voluntary vaccination; movement restrictions lifted early.
- **Surveillance:** Stakeholder engagement ensured strong reporting compliance.
- **Challenges:** Low vaccination rates; lack of compensation hindered farmer participation.

Carrie Batten
Head of the Non Vesicular Reference Laboratory
The Pirbright Institute

United Kingdom

The UK detected its first serological BTV-3 cases in 2023, linked to windborne incursions of infected Culicoides midges from the Netherlands into Kent and Norfolk. By late 2024, 153 holdings were declared positive. Initial culling was used to prevent overwintering, but this was later replaced with surveillance and movement controls. Vaccination uptake remained low, partly due to the costs and administrative hurdles farmers faced in obtaining licenses and due to the low clinical incidence observed locally. Despite robust testing and serotyping efforts, the economic impact of the outbreak remains unquantified. As an island nation, the UK leveraged its geographic advantage to limit the spread, but concerns over underreporting persist. The UK's proactive approach to outbreak containment demonstrated its potential to manage future outbreaks more effectively, provided vaccination rates improve.

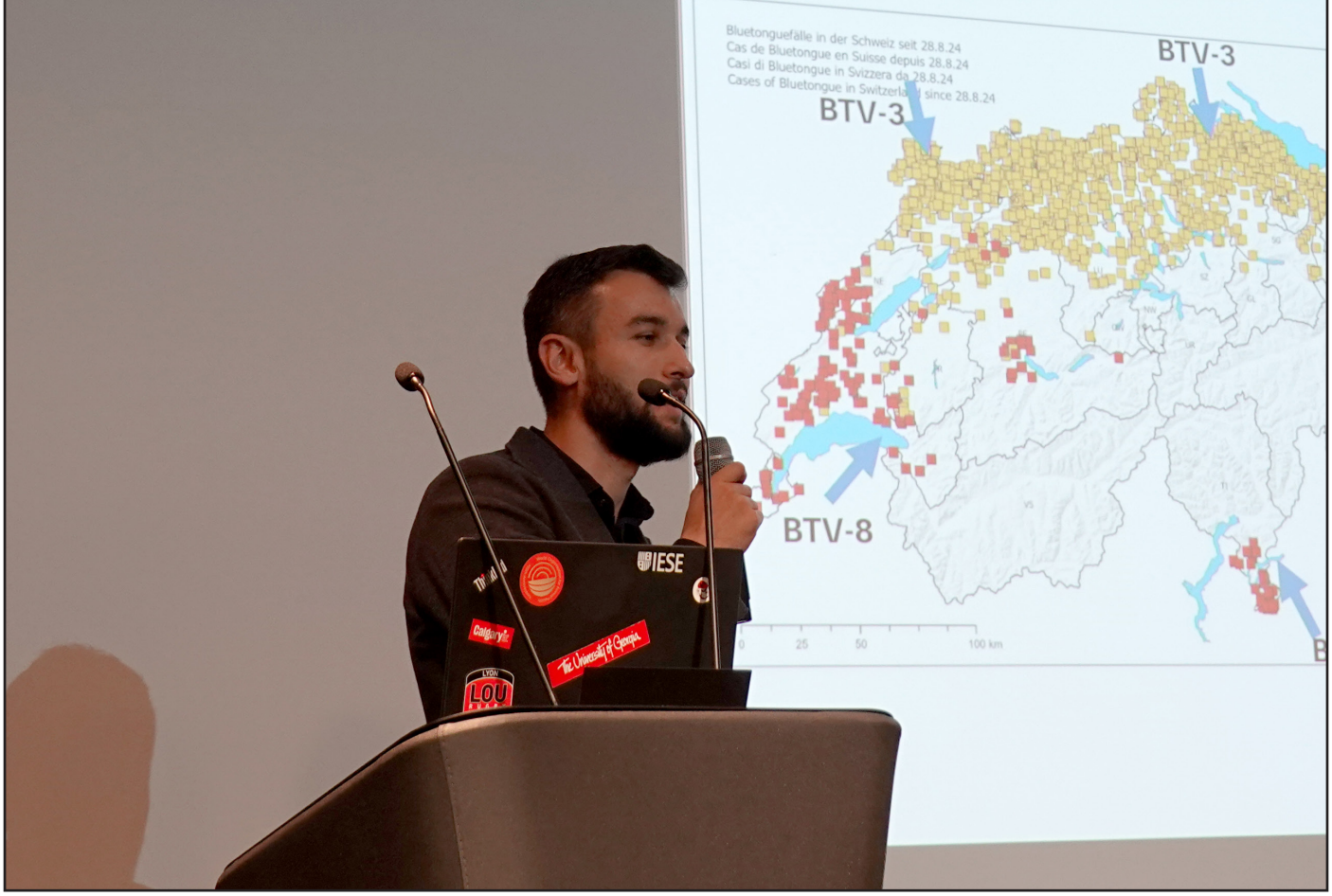
- **Outbreak Data:** First cases detected in 2023 from windborne incursions; 153 holdings positive by 2024.
- **Economic Impact:** No quantified losses; control measures imposed costs on farmers.
- **Control Measures:** Initial culling followed by movement restrictions; vaccination on request.
- **Surveillance:** Extensive testing in restricted zones; serotyping confirmed limited spread.
- **Challenges:** Low vaccination uptake; underreporting suspected

Friedrich Schmoll
Head of AGES Animal Health
AGES - University

Austria

Austria reported BTV-3 and BTV-4 outbreaks in 2024, primarily near the German and Italian borders. The outbreaks were limited, with 54 BTV-3 cases in cattle and 21 in sheep, and most animals showed no clinical signs. Mortality rates were minimal, and economic impacts were negligible. Movement restrictions applied to infected farms, while regional surveillance was intensified with monthly sampling of unvaccinated cattle and vector monitoring. Vaccination was voluntary and focused on high-risk regions. Carcass collection was manageable due to low mortality. Trade restrictions impacted animal movement across borders. Austria's alpine geography played a role in limiting disease spread. The country remains vigilant with active monitoring programs.

- **Outbreak Data:** BTV-3 and BTV-4 detected in 2024, with minimal clinical signs. 54 BTV-3 cases in cattle; 21 in sheep.
- **Economic Impact:** Unquantified due to low mortality and limited outbreaks.
- **Control Measures:** Voluntary vaccination prioritized in high-risk regions.
- **Surveillance:** Active monthly sampling in 28 regions; vector monitoring in place.
- **Challenges:** Minimal carcass collection needs due to low mortality; Trade restrictions imposed movement limitations.



Jakub Kubacki
Head of Vector-borne Diseases IVI
Swiss reference laboratory Institute for Virology and Immunology Institute of Virology and Immunology IVI

Switzerland

Switzerland detected BTV-3 and BTV-8 in August 2024, with outbreaks affecting 22 of its 26 cantons, primarily in northern regions. Mortality rates were low (0.5% in cattle, 2% in sheep), and no economic assessments were conducted. The country implemented restriction zones, with quarantines for infected farms. Vaccination approval was delayed until October 2024, leaving the country without immunized livestock during the outbreak. Surveillance efforts included PCR testing, vector monitoring, and sequencing of serotypes. Trade restrictions limited movement between cantons and internationally. The government recommended vaccination for 2025 to mitigate future outbreaks. Farmers adhered well to control measures.

- **Outbreak Data:** BTV-3 and BTV-8 detected in August 2024; 22 cantons affected: Mortality rates: 0.5% in cattle, 2% in sheep.
- **Economic Impact:** Limited due to low mortality and naïve vaccination status.
- **Control Measures:** Whole-country restriction zone; quarantine for positive farms.
- **Surveillance:** PCR confirmed cases; vector monitoring expanded.
- **Challenges:** Vaccination not implemented yet. Trade restrictions applied in unaffected cantons.

Ruben Villalba Martínez
EU Reference Laboratory for African horse sickness and Bluetongue Central Veterinary Laboratory (LCV)

Spain

Spain faced a complex Bluetongue scenario in 2024, with co-circulation of BTV-1, BTV-3, BTV-4, and BTV-8. Outbreaks included 179 cases of BTV-3, predominantly affecting sheep. Mortality data and economic impacts were unavailable, but co-infections complicated control efforts. Vaccination campaigns targeted specific serotypes, but limited availability hindered rapid response. Surveillance relied on PCR-based diagnostics, but testing capacity was overwhelmed by high sample volumes. Carcass collection delays were reported, and trade restrictions further strained the livestock sector. Spain emphasized multivalent vaccine development and enhanced diagnostic capacity to address future outbreaks. Challenges persisted in monitoring and managing diverse serotype dynamics.

- **Outbreak Data:** Co-circulation of BTV-1, BTV-3, BTV-4, and BTV-8. 179 outbreaks of BTV-3 in 2024, with multiple serotypes causing co-infections.
- **Economic Impact:** Not assessed but significant due to surveillance and vaccine costs.
- **Control Measures:** Vaccination campaigns implemented but challenged by co-circulating serotypes.
- **Surveillance:** Typing and sequencing for multiple serotypes; PCR-based testing for surveillance.
- **Challenges:** Delayed carcass collection overwhelmed labs. Trade restrictions complicated livestock movement.

Ana Luísa Pereira
União dos ADS do Alentejo
Coordinator Veterinarian

Portugal

Portugal reported its first BTV-3 case in September 2024, with outbreaks spreading across the country. Sheep were most affected, with high lamb mortality, abortion rates, and reduced milk production. Mortality surged by 109% in October compared to the previous year. Voluntary vaccination began late in 2024, with limited vaccine availability. Control measures included regional movement restrictions, later expanded nationwide. Surveillance was PCR-based but hindered by underreporting and limited diagnostic capacity. Trade restrictions halted exports, exacerbating economic losses. Farmers faced significant challenges, including lambing shortages and increased costs for disease management. Multivalent vaccines and preventive strategies were prioritized for 2025.

- **Outbreak Data:** BTV-3 detected in September 2024; high mortality in sheep during lambing. Mortality increased by 109% in late October.
- **Economic Impact:** Severe losses reported, including lambing shortages for 2025.
- **Control Measures:** Regional restrictions replaced by nationwide movement controls. Vaccination voluntary but delayed.
- **Surveillance:** Focus on PCR testing; limited diagnostic capacity.
- **Challenges:** Carcass collection overwhelmed. Trade restrictions halted exports, exacerbating economic losses.

Giovani Savini
Medical Director - Veterinary Medicine Virology
Experimental Zooprophylactic Institute (IZS)

Italy

Italy experienced widespread Bluetongue outbreaks in 2024, with over 4,000 confirmed cases of BTV-3, BTV-8, and BTV-4. BTV-3 and BTV-8 caused high mortality, with fatality rates reaching 33% and 32.5%, respectively. Sardinia was heavily impacted, alongside regions like Calabria and Piemonte. Vaccination campaigns and movement restrictions were implemented, including PCR testing for animal transport. Surveillance systems combined active and passive monitoring, with specialized diagnostics for dual diseases. Delayed carcass collection and overwhelmed labs posed challenges. Economic impacts were significant but unassessed, with trade restrictions affecting movement within Italy and beyond. Italy emphasized enhanced surveillance and vaccine coverage for future control.

- **Outbreak Data:** Over 4,000 outbreaks in 2024; BTV-3 and BTV-8 were most severe. Case fatality rates reached 33% (BTV-3) and 32.5% (BTV-8).
- **Economic Impact:** High livestock losses; unassessed economic impact.
- **Control Measures:** Movement restrictions and PCR testing mandatory; vaccination campaigns expanded.
- **Surveillance:** Active and passive surveillance in place; PCR capable of dual-disease detection.
- **Challenges:** Delayed carcass collection; overwhelmed testing facilities. Trade restrictions impacted animal movement within and beyond Italy.

5. Round table: Analysis of the performance on vaccination of cattle & sheep. What did work in 2023/24 and what did not work? Do we have to do differently in 2025?

Guillaume Convert
VPH Technical Director India & LATAM
Boehringer Ingelheim AH France

The roundtable focused on evaluating the successes and shortcomings of Bluetongue Virus (BTV) vaccination campaigns for cattle and sheep during 2023–2024, while proposing strategies for 2025. Key points revolved around vaccine efficacy, challenges in implementation, cross-protection between serotypes, logistical issues, and the need for tailored vaccination strategies.

5.1. Vaccine Efficacy and Cross-Protection

Vaccines generally provided effective protection against clinical signs and viremia, even in emergency settings. Cross-protection was noted within serotypes, but issues arose regarding cross-neutralization across different serotypes.

Panelists highlighted that while Bluetongue vaccines could protect against multiple variants within a serotype, their efficacy against different serotypes remain limited. For example, animals in endemic areas exposed to multiple serotypes showed partial protection due to previous exposure.

Research on conserved epitopes, like VP-7 proteins, suggested marginal cross-reactive immunity, although more data is needed to confirm these findings.

5.2. Challenges in Vaccine Development and Distribution

Vaccine strains: The selection of strains remains crucial. Some questioned whether vaccines should always target the most pathogenic strains. However, experts clarified that the primary goal is immunogenicity against a given serotype rather than directly targeting strain pathogenicity.

Industrial challenges: Strain adaptation for mass production and ensuring sufficient antigen yields were identified as bottlenecks in scaling up vaccine production.

Regulatory hurdles: Temporary authorizations for vaccines restricted data collection, creating difficulties in evaluating long-term immunity and comparative performance across different vaccines.

5.3. Field Observations on Vaccination Outcomes

Vaccination campaigns showed variation in performance across regions, often influenced by the level of pre-existing immunity in livestock populations and vaccination campaigns timings (for example when vaccination occurs concomitantly with virus transmission by midges). Endemic areas (e.g., Sardinia, where serotypes 1, 4, and 16 circulated previously) demonstrated some "resistance" to new serotypes, reducing clinical signs in affected herds.

5.4. Buffer Zones and Targeted Vaccination Strategies

France successfully implemented buffer zones during previous outbreaks, notably in response to BTV-8 in 2007, creating a protected front line to curb the spread. However, questions arose about the feasibility of replicating this approach in other countries with limited vaccine supplies or when vaccination is not compulsory.
Coverage within buffer zones needs to achieve 70–80% to be effective. Experts debated whether the buffer zone thickness or the number of vaccinated animals was more critical for controlling outbreaks.

5.5. Addressing Logistical and Implementation Challenges

Voluntary versus mandatory vaccination: Regions like Belgium and the Netherlands saw limited voluntary uptake due to cost barriers and skepticism about vaccine efficacy. Experts stressed the importance of mandatory vaccination to ensure sufficient coverage. Implementing such a strategy with BTV being classified Category-C disease in the EU regulation is challenging
Timing: Vaccinating young animals remains complex due to maternal antibody interference. Strategies include vaccinating sheep at 3 and 5 months to address immunity gaps.

Species-specific challenges: Goats, though less susceptible, showed different clinical presentations, including neurological symptoms and vertical transmission. Economic considerations and limited data hindered widespread vaccination for goats.

5.6. Future Directions and Recommendations for 2025

Improve vaccine supply: Stakeholders emphasized the need for multivalent vaccines capable of addressing multiple serotypes simultaneously, especially in regions with overlapping serotypes.
Enhance regulatory clarity: Early approvals and streamlined processes for new vaccine authorizations were highlighted as critical to addressing future outbreaks.
Increase vaccination incentives: Linking vaccination to trade facilitation (e.g., allowing movement of vaccinated animals without additional testing) was proposed to encourage uptake.
Leverage combined immunity: Experts called for further research into sequential vaccination strategies and the role of cellular immunity in providing broader protection.
Address communication gaps: Manufacturers need clearer guidance from countries on target serotypes and desired vaccination policies

6. First round table
Vaccination campaigns and BTV spread: targeting eradication?

Stéphan Zientara
Director of the Animal Health Laboratory
National Agency for Food, Environmental and Occupational Health and Safety (ANSES)

Pascal Hudelet
Head of VPH Technical Services
Boehringer Ingelheim AH France

Giovanni Savini
Medical Director - Veterinary Medicine Virology
Experimental Zooprophylactic Institute (IZS)

6.1. Keynote by Giovanni Savini: Lessons from Italy

Dr. Savini presented Italy's quarter-century struggle with BTV, focusing on the economic and logistical challenges posed by this segmented virus. Key highlights included:

BTV Complexity: As a segmented genome virus, BTV exhibits reassortment potential, creating progeny with new virulence or transmission traits. Co-circulating strains (e.g., BTV-3 and BTV-8) increase the likelihood of reassortment, complicating eradication efforts.

Vaccination Objectives: Vaccination aims to protect animals, enable livestock movement, and limit viral spread, with eradication as an aspirational goal.

Economic Analysis: The 2017 BTV-4 epidemic in Sardinia cost €30 million, far outweighing the €7 million required for vaccination. This underscores the economic efficiency of proactive vaccination strategies.

Tailored Approaches: Strategies varied by region:
- Northern Italy prioritized monovalent vaccination for serotype 8.
- Sardinia adopted targeted vaccination in high-risk areas, focusing on sheep.
- Timing of vaccination significantly influenced outcomes, with late vaccination reducing efficacy during outbreaks but aiding in the subsequent vector season.

Challenges in Voluntary Programs: Italy's experience revealed that voluntary vaccination often failed to achieve the coverage required for eradication.

6.2. Panel Discussion: Key Themes and Insights

Vaccination Efficacy and Immunity Duration

• Efficacy Variability: Inactivated vaccines generally performed well, with some providing sterilizing immunity. However, some unsatisfactory field results were influenced by late vaccinations and co-circulating serotypes.

Immunity Duration

• Lifelong immunity was observed after natural infection or live-attenuated vaccination.
• Inactivated vaccines require boosters, with efficacy lasting about a year, though BTV-8 vaccinal immunity showed surprising longevity (detectable antibodies up to 5–6 years in some cases).
• Bulk milk testing revealed long-lasting residual antibodies in vaccinated herds, suggesting ongoing protection.

Economic and Welfare Considerations

• Trade and Costs: Vaccination facilitated livestock movement and reduced reliance on costly PCR testing, which costs approximately €20 per test. Regions reliant on trade prioritized vaccination to meet export requirements.
• Animal Welfare: Panelists emphasized the devastating impact of BTV on animal health, while statistics stress high mortality rate, the extreme suffering of sick animals increasing farmers and vets' distress, should be considered according to the EU animal welfare legislation.
• One-Health and AntiMicrobial Resistance (AMR) : the misuse of antibiotics as farmers attempted to manage symptoms and its potential consequences on AMR was stressed.

Reassortment Risks and Serotype Dynamics

• Reassortment Challenges: Co-circulation of serotypes like BTV-3, BTV-4 and BTV-8 created ideal conditions for reassortment, potentially producing more virulent or transmissible strains. The recent BTV-3 fast spread in Sardinia was linked to a reassortment between the former slow-spreading serotype 3 and co-circulating serotype 4.
• Geographical Variations: Reassortment was observed across Italy, with new strains spreading beyond traditional areas of circulation. This phenomenon was linked to differences in vector species and climate conditions.

Voluntary vs. Compulsory Vaccination

• Voluntary Campaigns: Regions relying on voluntary vaccination struggled to achieve high coverage, with farmers citing costs and skepticism about vaccine efficacy.
• Compulsory Strategies: Sardinia demonstrated the success of compulsory vaccination in high-risk areas, but logistical challenges remained, particularly with large sheep populations.

6.3. Targeting Eradication: Feasibility and Recommendations

Panelists debated whether BTV eradication is feasible, given the challenges of achieving high vaccination coverage and addressing reassortment risks. Key takeaways included:

Lessons from BTV-8: Eradication campaigns for BTV-8 succeeded in northern Europe due to mandatory vaccination and robust funding. However, replicating this success for other serotypes faces economic and logistical barriers.

Regulatory and Funding Gaps: Under the current categorization of BTV as a "Category C" disease in Europe, responsibility falls to farmers, limiting government involvement. Panelists advocated upgrading BTV's status to ensure better funding and coordination.

Innovative Vaccines: Panelists called for investments in next-generation vaccines, including multivalent or genetically modified options, to address the diverse serotypes and enhance efficacy.

Economic Justification: Better economic modeling is needed to demonstrate the cost-effectiveness of eradication campaigns, especially for trade-dependent regions.

Animal Welfare Priority: Beyond economic benefits, vaccination campaigns were framed as critical for addressing the significant welfare issues posed by BTV.

6.4. Country-Specific Insights

Panelists provided perspectives on their countries' approaches:

- **Italy:** Focused on targeted vaccination in high-risk areas and livestock intended for trade.
- **Germany:** No eradication program exists; reliance on natural extinction of outbreaks.
- **Netherlands:** Farmers vaccinated primarily to protect livestock from devastating clinical effects, though eradication was viewed as unlikely.
- **France:** Vaccination prioritized for trade facilitation, though the virulence of recent strains has shifted focus to minimize BTV clinical impact and consequences on animal welfare.
- **UK:** Lessons from successful BTV-8 campaigns underscored the need for coordinated efforts, but voluntary vaccination limited coverage.

Conclusion

The roundtable concluded that while eradication remains a theoretical goal, achieving it requires significant changes in strategy, including:

- Mandating vaccination to ensure sufficient coverage.
- Enhancing vaccine development to address multiple serotypes.
- Securing greater government support through reclassification of BTV as a higher-priority disease particularly for "exotic" serotypes.
- Prioritizing animal welfare in discussions about vaccination campaigns.

Eradication is unlikely under current conditions, but improved collaboration and investment could transform how BTV outbreaks are managed in the future.

7. 2nd round table
Cattle or sheep: Is there a species to vaccinate in priority?

Stéphan Zientara
Director of the Animal Health Laboratory
National Agency for Food, Environmental and Occupational Health and Safety (ANSES)

Pascal Hudelet
Head of VPH Technical Services
Boehringer Ingelheim AH France

Claire Garros
Head of the Vector team
Centre for International Cooperation in Agricultural Research for Development (CIRAD)

Multiple ruminant species are at risk for Bluetongue Virus (BTV). However, this disease is considered not contagious. It is individually transmitted by midges. BTV is a vector-borne disease. A better understanding of its midges' vector could help to explore the prioritization of vaccination efforts against BTV, focusing on whether cattle or sheep should be prioritized. Claire Garros delivered a keynote addressing the interspecies dynamics of virus transmission via Culicoides biting midges, providing the foundation for a panel discussion on vaccination strategies, vector control, and environmental impacts.

7.1. Keynote by Claire Garros: Interspecies Transmission by Culicoides

Garros' presentation emphasized the complexities of Culicoides as vectors for BTV and related viruses like Schmallenberg and Epizootic Hemorrhagic Disease Virus (EHDV).

Key insights included:

Vector Characteristics:

• Culicoides are small hematophagous insects with a global distribution, presenting challenges in their study due to their fragility and high mortality in laboratory settings.

• Vector competence is determined by host-vector contact, the ability to replicate and transmit the virus, and field evidence of viral presence in midges.

Transmission Dynamics:

• Midges bite viremic animals, potentially becoming infectious after the virus crosses the midgut barrier and disseminates to the salivary glands. This pathway is called Extrinsic Incubation Period (EIP).

• Seasonal and daily activity patterns vary, with higher transmission risks during warm months and peak activity at dawn and dusk.

Host Preferences:
• Some Culicoides species, like C. chiopterus, exhibit strong associations with cattle, while others are generalist feeders, biting multiple species including sheep, horses, and occasionally wildlife.

Environmental Influence:
• Climate change shortens the extrinsic incubation period (EIP) of the virus, increasing the risk of year-round transmission in warmer regions.

Garros concluded that vaccination strategies should account for species density, vector behavior, and regional environmental conditions.

7.2. Panel Discussion: Prioritizing Vaccination Efforts

The panel examined the implications of Garros' findings, focusing on species-specific vaccination strategies to minimize BTV spread and impact. This, considering the observation that the more animals are affected, the more serious the symptoms observed.

Cattle as Reservoir Hosts
• Cattle play a critical role in BTV transmission due to their prolonged viremia (up to 60 days) and ability to attract large numbers of midges. They often act as silent reservoirs, maintaining the virus during inter-epidemic periods.
• Vaccination of cattle was advocated as a means to reduce the overall viral load in vectors, indirectly protecting sheep and other susceptible species.
• Trade considerations make cattle vaccination economically essential in regions dependent on livestock exports.

Sheep as Highly Susceptible Hosts
• Sheep experience severe clinical disease, including high mortality and farmers support major economic losses. Vaccination in sheep reduces clinical symptoms and prevents spill over into other species.
• In regions dominated by sheep farming, prioritizing sheep vaccination was considered critical to curbing outbreaks and limiting economic losses.

7.3. Challenges and Strategies

Eradication Feasibility

• Panelists agreed that eradication requires vaccinating over 95% of susceptible populations for at least five years. Achieving such high coverage is logistically challenging, especially with voluntary vaccination programs.

• Eradication campaigns must address all susceptible species, including cattle, sheep, goats, and potentially wildlife in high-density regions.

Wildlife's Role in Transmission

• Wildlife, particularly deer, plays a limited role in BTV transmission in northern Europe. However, in southern Europe, deer populations may act as reservoirs, complicating eradication efforts.

• Vaccinating wildlife was deemed unnecessary, but their role should be monitored in regions with high densities of susceptible wild animals.

Climate Change and Vector Dynamics

• Climate change is extending the transmission season and reducing the EIP, leading to increased virus spread and higher transmission risks in traditionally low-risk seasons like spring.

• Indoor housing and mechanical ventilation for livestock were identified as effective, environmentally friendly measures to reduce midge bites and BTV transmission within farms.

Vector Control

• Chemical control methods, such as deltamethrin pour-on, showed limited efficacy, with short-term effects requiring frequent application. Environmental concerns further limit their use in Europe.

• Alternative strategies, including improving farm design (e.g., ventilation systems) and exploring new-generation vaccines, were proposed as long-term solutions.

7.4. Key Takeaways and Recommendations

The discussion highlighted the need for a balanced vaccination approach tailored to regional conditions and species composition. Key recommendations included:

Prioritize Vaccination of Reservoir Hosts (Cattle):
• Focus on reducing viral load in cattle to minimize transmission risks to sheep and other species.
• Ensure vaccination coverage in trade-dependent regions to facilitate livestock movement.

Protect Susceptible Hosts (Sheep):
• Target sheep in high-risk areas to prevent severe clinical outcomes and economic losses.
• Implement compulsory vaccination in regions with high sheep densities to ensure sufficient coverage.

Address Environmental and Climate Challenges:
• Invest in farm improvements, such as ventilation systems, to mitigate vector activity and enhance animal welfare.
• Monitor the impact of climate change on transmission patterns and adapt strategies accordingly.

Explore Integrated Approaches:
• Combine vaccination with mechanical and chemical control methods to optimize results.
• Continue research into next-generation vaccines capable of addressing multiple serotypes.

Strengthen Collaboration and Data Sharing:
• Enhance surveillance of wildlife and vectors to better understand their roles in BTV transmission.
• Share epidemiological and vaccine performance data across regions to refine strategies.

Conclusion

The roundtable concluded that a species-specific vaccination strategy is essential to controlling BTV. While cattle are critical reservoirs requiring prioritized vaccination, sheep must also be protected due to their susceptibility to severe disease. Success depends on comprehensive coverage, integration with vector control, and adaptation to evolving climatic and epidemiological conditions.

8. 3rd round table
Drawing sanitary policies to secure ruminant trade inside/outside Europe

Guillaume Convert
VPH Technical Director India & LATAM
Boehringer Ingelheim AH France

Gordon Hickman
Head of Exotic Disease Control
Department for Environment Food & Rural Affairs (DEFRA)

The third roundtable centered on developing effective sanitary policies to facilitate ruminant trade within Europe and with external partners, particularly during and after outbreaks of Bluetongue Virus (BTV). The discussion was launched with a keynote by Gordon Hickman, focusing on expectations from vaccines and diagnostic tests to support trade under regulatory and economic pressures. Key topics included disease control strategies, the economic impact of trade restrictions, and innovations in diagnostic and vaccination tools.

8.1. Keynote by Gordon Hickman: What to Expect from Vaccines and Diagnostic Tests

Hickman highlighted the challenges and expectations policymakers face in managing BTV to minimize trade disruption while ensuring effective disease control.

The Role of Vaccines
• Impact on Trade: Vaccines reduce clinical disease, viremia, and viral transmission, allowing safe animal movement. Effective multivalent vaccines targeting circulating serotypes are crucial, especially for regions with overlapping serotypes.
• Limitations: Current vaccines often lack long-lasting immunity and universal serotype coverage, necessitating boosters and specific strain targeting.

Future Needs:
• Evidence of Long duration of immunity (minimum six months) to ensure trade eligibility.
• DIVA-compatible vaccines for easier distinction between vaccinated and infected animals, essential for surveillance and certification.

Diagnostic Tools
• PCR and Serological Tests: Critical for identifying infected animals and certifying trade eligibility.

Innovation Needs:
• Portable, rapid diagnostic tools for on-site testing.
• Multiplex molecular tools for simultaneous detection of multiple serotypes.

8.2. Panel Discussion: Key Challenges and Insights

Harmonizing Policies Across Europe

• Variability in vaccination and testing protocols across countries creates barriers to cross-border trade. A unified EU policy is essential for consistent disease management.
• UK Perspective: The UK, no longer constrained by EU animal health laws, developed independent policies, such as targeted testing zones and voluntary vaccination, to balance disease containment with trade facilitation.

Economic and Operational Impact

• Economic Losses: Trade restrictions during outbreaks impose significant costs on farmers, particularly for high-value breeding stock. Limited vaccine coverage exacerbates these challenges.
• Surveillance Costs: Intensive testing programs, such as those in the UK, are expensive and difficult to justify economically unless they significantly delay or mitigate outbreaks.

Vaccination Strategies

Voluntary vs. Compulsory:

• Voluntary vaccination programs often fail to achieve adequate coverage, particularly among commercial farmers focused on cost-saving.
• Compulsory vaccination, as seen in some European countries, ensures higher coverage but faces resistance from farmers due to costs and logistical challenges.
• Targeted Vaccination: High-risk zones require prioritized vaccination to prevent disease spread. However, uptake is often limited to pedigree and high-value herds, leaving commercial populations under protected.

Challenges of Diagnostic Testing

• Post-Vaccination PCR Positivity: PCR tests may yield false positives shortly after vaccination, complicating trade certifications. Field recommendations include waiting periods before testing to avoid misinterpretation.
• Multiplex Diagnostics: Panelists called for diagnostic advancements capable of testing multiple serotypes in a single assay to reduce costs and improve efficiency.

8.3. Strategies to Address Policy and Practical Gaps

Enhancing Trade-Specific Vaccines

• Develop vaccines with guaranteed immunity duration and compatibility with trade requirements.
• Promote investments in DIVA-compatible vaccines and serotype-specific diagnostic tools.

Strengthening Surveillance Networks

• Expand regional and national lab capacities for rapid diagnosis.
• Integrate bulk milk testing and serotype-specific PCR tools to enhance population-level monitoring.

Balancing Trade and Disease Control

• Establish risk-based trade zones with differential testing and vaccination requirements.
• Incentivize vaccination by linking it to streamlined trade approvals and subsidies for vaccine costs.

Preparing for Future Serotypes

• Address potential incursions of emerging serotypes like BTV-12 by enhancing predictive models and stockpiling vaccines.
• Invest in multivalent vaccines capable of addressing a broader range of serotypes.

8.4. Policy Outlook and Recommendations

The discussion highlighted a pressing need for harmonized, science-driven policies to balance trade facilitation with robust disease control measures:

Vaccination as a Trade Enabler:
• Prioritize vaccination in high-risk regions and trade-reliant economies to minimize disruptions.
• Mandate vaccination programs in regions with a history of severe outbreaks.

Diagnostic Innovations:
• Develop affordable, portable tools for rapid, on-site diagnostic testing.
• Promote serotype-specific diagnostic assays to streamline certification processes.

Unified Policy Framework:
• Advocate for consistent EU-wide regulations to avoid trade disparities and streamline disease management.
• Strengthen cooperation between EU and non-EU countries on vaccine production, trade policies, and disease monitoring.

Enhanced Farmer Engagement:
• Educate farmers on the economic and welfare benefits of vaccination.
• Subsidize vaccines and diagnostics to ensure participation from commercial and small-scale producers.

Long-Term Preparedness:
• Establish multilateral contingency plans for future serotype outbreaks.
• Invest in predictive epidemiological models to inform policy decisions.

Conclusion

The roundtable underscored the critical role of vaccines and diagnostics in securing ruminant trade while maintaining disease control. Balancing trade facilitation with public and animal health requires a unified, collaborative approach, leveraging innovation and harmonized policies to address current and future challenges.

9. Conclusions and recommendations

The final session synthesized insights from the previous roundtables and discussions, focusing on practical recommendations, existing challenges, and areas requiring further investment to improve Bluetongue Virus (BTV) management and policy. The session highlighted variability in national approaches, gaps in knowledge, and opportunities to enhance coordination and innovation.

9.1. Key Insights from Roundtables

Variability in National Approaches

• Significant differences exist in how countries address BTV outbreaks, including vaccination strategies, surveillance intensity, and regulatory frameworks. Some countries, like Belgium, have embraced mandatory vaccination, while others rely on voluntary programs.
• Countries with severe outbreaks experienced substantial animal welfare and economic impacts, while others faced mild outbreaks, underscoring the role of regional factors in disease spread and pathogenicity.

Surveillance and Modeling

• Surveillance systems were praised for detecting outbreaks early, enabling better containment measures. Innovations such as bulk milk testing and environmental surveillance were noted as promising tools.
• Modeling was identified as a vital yet underutilized resource for simulating various vaccination and containment scenarios, which could improve decision-making and preparedness.

Vaccination Goals

• Clear strategies are required for vaccination, whether targeting eradication or minimizing outbreaks. Countries aiming for eradication need near-complete population coverage, achievable only through mandatory programs.
• Preventive vaccination before outbreaks is limited by regulatory restrictions, which often require confirmed cases before vaccine deployment.

9.2. Identified Gaps and Challenges

Knowledge Gaps

• Vector Ecology: Limited understanding of Culicoides vector behavior and transmission cycles hinders targeted control efforts. Research is needed to address questions about vector-host dynamics and environmental factors affecting transmission.
• Virulence Factors: Variability in virulence between and within serotypes and outbreaks, such as BTV-3's mild behavior in some regions versus severe outbreaks elsewhere, needs further investigation.
• Economic Impact: Data on the economic costs of BTV across countries are incomplete, complicating cost-benefit analyses for control measures like vaccination and animal movement restrictions.

Policy Gaps

• Current EU regulations categorize BTV as a «Category C» disease, limiting coordinated eradication efforts. Participants emphasized the need to reclassify BTV to encourage more robust funding and policy action.
• Regulations preventing preventive vaccination (before confirmed outbreaks) delay response efforts and increase disease spread.

2.3. Resource and Infrastructure Gaps

• Insufficient vaccine or antigen banks and the high cost of producing multivalent vaccines restrict rapid deployment.
• Experimental vaccination and challenge trials face delays due to limited biosafety facilities and lengthy protocol approvals.

9.3. Recommendations

Strengthen Vaccination Strategies

• Current inactivated vaccines are cheap and efficient. The most relevant strategy is stockpiling antigens. Innovative vaccines approaches are feasible, but their high expected costs limit their relevance.

• Proactive Vaccination: Establish antigen banks for priority serotypes (e.g., BTV-3, BTV-8, BTV-4) to enable rapid deployment. Collaborate with industry and policymakers to fund pre-competitive development of master seeds (e.g. BTV-12...).

• Multivalent Vaccines: Invest in next-generation vaccines capable of addressing multiple serotypes with longer immunity durations.

• Farmer Engagement: Build trust in vaccination through targeted education and communication campaigns, emphasizing welfare and economic benefits.

Enhance Surveillance and Diagnostics

•Diagnostic Innovations: Develop serotype-specific PCR tools and multiplex assays for efficient and cost-effective detection of multiple serotypes in a single test.

• Environmental Surveillance: Expand bulk milk and environmental testing to improve early detection and outbreak monitoring.

• Modeling: Utilize advanced epidemiological models to simulate various scenarios, including vaccination strategies and movement restrictions.

Policy Reforms

• Regulatory Adjustments: Reclassify BTV as a «Category B» disease in Europe to enable coordinated eradication efforts and secure funding.

Streamline Vaccine Authorization: Shorten the time between outbreaks and vaccine deployment by adopting emergency approval frameworks.

Foster International Cooperation

• Establish an EU-wide emergency response framework like the human health model for rapid coordination and resource mobilization during outbreaks.

• Promote pre-competitive collaboration between governments, academia, and industry to develop and maintain vaccine or antigen banks.

9.4. Long-Term Vision

The session emphasized shifting from reactive to proactive disease management. By investing in research, innovative technologies, and collaborative frameworks, BTV outbreaks can be better managed and potentially eradicated in the long term. Key proposals included:

• Expanding experimental facilities for challenge trials to accelerate vaccine development.

• Current inactivated vaccines are cheap and efficient best strategy is stockpiling antigens. Innovative vaccines approaches are feasible, but their high expected costs limits their relevance

• Encouraging farmers to adopt vaccination as a routine practice through incentives and simplified protocols.

Conclusion

The conclusions underscored the importance of aligning national policies, improving knowledge, and fostering innovation to address the challenges posed by BTV. By leveraging advancements in diagnostics, vaccination, and modeling, countries can mitigate the impact of future outbreaks while securing safe and sustainable trade in ruminants.

10. Annex 1

Agenda: BTV Symposium: «Navigating the Outbreak in Europe»

Monday November 4, 2024

Morning Session

Time	Topic	Presenters	Timing	Location
08:30 - 09:00	**Welcome Coffee**		30'	Bistrot Ground Floor
09:00 - 09:15	**Introduction**	Gerald Behrens	15'	Auditorium Frères Lumière Ground Floor
09:15 - 09:40	**Retrospective 2023-2024 BTV-3: drawing a parallel with BTV-8 - with Q&A**	Guillaume Convert & Katrien Van Den Brink	25'	
09:40 - 09:45	**Introduction countries review & feedback** Impact of the epizootic on territories, vaccination strategies & outcomes	Pascal Hudelet	5'	
09:45 - 09:55	• Netherlands	Melle Holwerda	10'	
09:55 - 10:05	• Belgium	Ilse de Leeuw / Laura Praet	10'	
10:05 - 10:15	• Germany	Michael Eschbaumer / Martin Beer	10'	
10:15 - 10:25	• France	Stéphan Zientara	10'	
10:25 - 10:35	• Denmark	Signe Balslev / Ida Tingman Moller	10'	
10:35 - 10:45	• United Kingdom	Carrie Batten	10'	
10:45 - 11:15	**Break**		30'	Bistrot Ground Floor
11:15 - 11:25	• Switzerland	Jakub Kubacki	10'	Auditorium Frères Lumière Ground Floor
11:25 - 11:35	• Austria	Friedrich Schmoll	10'	
11:35 - 11:45	• Spain	Ruben Villalba Martínez	10'	
11:45 - 11:55	• Portugal	Ana Luísa Pereira	10'	
11:55 - 12:05	• Italy	Giovani Savini	10'	
12:05 - 12:50	**Round table** Analysis of the performance on vaccination of cattle & sheep: What did work in 2023/24 and what did not work? Do we have to do differently in 2025?	Guillaume Convert	45'	

Monday November 4, 2024

Afternoon Session

Time	Topic	Presenters	Timing	Location
13:00 - 14:00	**Lunch**		60’	Bistrot Ground Floor
14:00 - 14:05	**Introduction** **Future Projection for 2025:** What to expect and how to anticipate?		5’	Auditorium Frères Lumière Ground Floor
14:05 - 15:05	**1st round table** Vaccination campaigns and BTV spread : targeting eradication?	Moderation: Stéphan Zientara, Pascal Hudelet	60’	
	Introduced by short keynote: What can we expect from several BTV serotypes (and/or ehdv) circulating in the same area	Giovanni Savini		
15:05 - 16:05	**2nd round table** Cattle or sheep : Is there a species to vaccinate in priority?	Moderation: Amandine Bibard, Guillaume Convert	60’	
	Introduced by short keynote: Interspecies transmission by culicoides. Who contaminates who and when?	Claire Garros		
16:05 - 16:30	**Coffee break**		25’	Bistrot Ground Floor
16:30 - 17:30	**3rd round table** Drawing sanitary policies to secure ruminant trade inside/outside Europe	Moderation: Guillaume Convert	60”	Auditorium Frères Lumière Ground Floor
	Introduced by short keynote: What to expect from vaccines and diagnostic tests to release EU ruminant trade	Gordon Hickman		
17:30 - 18:30	**Q&A**	All participants	60”	
19:00	Departure for offsite dinner in the old city			Restaurant Les Lyonnais

10. Annex 1
Speakers list

Country	First Name	Name	Company / Institution	Position	Email
Netherlands	Katrien	Van Den Brink	Royal GD Animal Health	Cattle veterinarian infectious diseases - Dairy specialist	k.vd.brink@gddiergezondheid.nl
	Melle	Holwerda	Wageningen University & Research (WUR)	Head of the NRL for vector-borne and zoonotic viral diseases & Project leader	melle.holwerda@wur.nl
	Monique	Driesse	Boehringer Ingelheim AH Belgium	Senior Technical Service Manager	monique.driesse@boehringer-ingelheim.com
Belgium	Ilse	De Leeuw	Sciensano	Expert NRL Bluetongue Belgium	Ilse.DeLeeuw@sciensano.be
Germany	Martin	Beer	Friedrich-Loeffler-Institut (FLI)	Head of Institute and Vice-President	martin.beer@fli.de
France	Claire	Garros	Centre for International Cooperation in Agricultural Research for Development (CIRAD)	Head of the Vector team	claire.garros@cirad.fr
	Guillaume	Convert	Boehringer Ingelheim AH France	VPH Technical Director India & LATAM	guillaume.convert@boehringer-ingelheim.com
	Pascal	Hudelet	Boehringer Ingelheim AH France	Head of VPH Technical Services	pascal.hudelet@boehringer-ingelheim.com
	Stéphan	Zientara	National Agency for Food, Environmental and Occupational Health and Safety (ANSES)	Director of the Animal Health Laboratory	Stephan.ZIENTARA@anses.fr
Denmark	Ida	Tingman Moller	Danish Agriculture & Food Council (L&F)	Senior Consultant DVM	idtm@lf.dk
	Tenna	Jensen	Danish Veterinary and Food Administration (FVST)	Veterinarian	teje@fvst.dk

Country	First Name	Name	Company / Institution	Position	Email
United-Kingdom	Carrie	Batten	The Pirbright Institute	Head of the Non-Vesicular Reference Laboratory	carrie.batten@pirbright.ac.uk
	Gordon	Hickman	Department for Environment Food & Rural Affairs (DEFRA)	Head of Exotic Disease Control	gordon.hickman@defra.gov.uk
	Simon	Gubbins	The Pirbright Institute	Group leader in Transmission Biology	simon.gubbins@pirbright.ac.uk
Austria	Friedrick	Schmoll	AGES – University	Head of AGES Animal Health	friedrich.schmoll@ages.at
Switzerland	Jakub	Kubacki	Swiss reference laboratory Institute for Virology and Immunology Institute of Virology and Immunology IVI	Head of Vector-borne Diseases IVI	jakub.kubacki@ivi.admin.ch
Spain	Ruben	Villalba Martínez	Central Veterinary Laboratory (LCV)	EU Reference Laboratory for African horse sickness and Bluetongue	rvillalba@mapa.es
Portugal	Ana Luísa	Pereira	União dos ADS do Alentejo	Coordinator Veterinarian	coordenadora@adslitoralalentejano.pt direcao@adslitoralalentejano.pt
Italy	Giovanni	Savini	Experimental Zooprophylactic Institute (IZS)	Medical Director - Veterinary Medicine Virology	Vet

11. Annex 2
Table Overview of countries

Country	Outbreak Data	Economic Impact	Control Measures	Surveillance	Challenges
Netherlands	First cases detected in September 2023; over 10,000 clinical suspicions reported by October 2024	Estimated loss of 60,000 livestock in 2023; economic costs remain unquantified.	72-hour trading standstill; vaccination campaigns with three available vaccines.	Early warning system enabled timely diagnostics; BTV-12 identified through field vigilance and retrospective studies	Underreporting and no farmer compensation limited the response to the outbreak
Belgium	BTV-3 first detected in October 2023; over 250 outbreaks in cattle and 1,000 in sheep in 2024	Sheep mortality increased by 191%; economic costs remain unclear.	No trade restrictions; voluntary vaccination with low uptake.	Outbreak progression monitored through extensive diagnostic efforts.	Delayed carcass collection; trade restrictions impacted the livestock sector.
Germany	Over 13,000 outbreaks reported by 2024; rapid spread without zoning	Significant livestock losses; excess mortality tracked through carcass removal facilities	Movement of animals allowed; widespread vaccination for sheep and cattle	Extensive vector monitoring and diagnostic testing	Vaccine efficacy concerns; unclear data on economic losses
France	Over 7,000 cases reported by October 2024; widespread across northern and southwestern regions	Estimated 3% losses in cattle and sheep; detailed economic data lacking.	Movement restrictions; 11 million vaccine doses procured	Regional labs conducted widespread PCR diagnostics.	Vaccine distribution delays and resistance from farmers hindered control measures.
Denmark	Over 800 outbreaks by November 2024; disease spread across the country.	Potential losses up to €100 million; mortality data incomplete.	Voluntary vaccination; movement restrictions lifted early.	Stakeholder engagement ensured strong reporting compliance.	Low vaccination rates; lack of compensation hindered farmer participation.
United-Kingdom	First cases detected in 2023 from windborne incursions; 153 holdings positive by 2024.	No quantified losses; control measures imposed costs on farmers.	Initial culling followed by movement restrictions; vaccination on request.	Extensive testing in restricted zones; serotyping confirmed limited spread.	Low vaccination uptake; underreporting suspected.
Austria	BTV-3 and BTV-4 detected in 2024, with minimal clinical signs. 54 BTV-3 cases in cattle; 21 in sheep.	Unquantified due to low mortality and limited outbreaks	Voluntary vaccination prioritized in high-risk regions	Active monthly sampling in 28 regions; vector monitoring in place.	Minimal carcass collection needs due to low mortality; Trade restrictions imposed movement limitations.
Switzerland	BTV-3 and BTV-8 detected in August 2024; 22 cantons affected: Mortality rates: 0.5% in cattle, 2% in sheep.	Limited due to low mortality and naïve vaccination status	Whole-country restriction zone; quarantine for positive farms	PCR confirmed cases; vector monitoring expanded.	Vaccination not implemented yet. Trade restrictions applied in unaffected cantons.
Spain	Co-circulation of BTV-1, BTV-3, BTV-4, and BTV-8. 179 outbreaks of BTV-3 in 2024, with multiple serotypes causing co-infections	Not assessed but significant due to surveillance and vaccine costs.	Vaccination campaigns implemented but challenged by co-circulating serotypes	Typing and sequencing for multiple serotypes; PCR-based testing for surveillance	Delayed carcass collection overwhelmed labs. Trade restrictions complicated livestock movement.
Portugal	BTV-3 detected in September 2024; high mortality in sheep during lambing. Mortality increased by 109% in late October	Severe losses reported, including lambing shortages for 2025.	Regional restrictions replaced by nationwide movement controls. Vaccination voluntary but delayed.	Focus on PCR testing; limited diagnostic capacity	Carcass collection overwhelmed. Trade restrictions halted exports, exacerbating economic losses
Italy	Over 4,000 outbreaks in 2024; BTV-3 and BTV-8 were most severe. Case fatality rates reached 33% (BTV-3) and 32.5% (BTV-8).	High livestock losses; unassessed economic impact.	Movement restrictions and PCR testing mandatory; vaccination campaigns expanded.	Active and passive surveillance in place; PCR capable of dual-disease detection.	Delayed carcass collection; overwhelmed testing facilities. Trade restrictions impacted animal movement within and beyond

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