

Limit the Population of Mosquito Vectors



Thematic Area: Health and Welfare.

Priority: What practices can be implemented to promote biosecurity measures and prevent emergent diseases?

Need: West Nile Virus: increase in outbreaks, probably linked to climate changes. How can we limit the risk?

Solution EU Number: HE-03.

Content of the Solution: Different measurements to limit the population of mosquitos as transmission vector.

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Reasons for Implementing this Solution

Mosquitoes in Europe serve as vectors for several serious equine diseases as West Nile Virus. A comprehensive system to control mosquitoes on equine farms helps prevent and manage vector-borne diseases.

Description of Solution Strategies

Mosquitoes in Europe serve as vectors for several serious equine diseases including:

- West Nile Virus (WNV) - increasingly prevalent in Southern and Central Europe.
- African Horse Sickness (potential threat with climate change in Southern Europe).
- Equine Infectious Anemia (EIA) - present in parts of Eastern and Southern Europe.
- Usutu virus - emerging threat in parts of Europe.
- Various forms of equine encephalitis.

The European Centre for Disease Prevention and Control (ECDC) has documented the northward spread of mosquito species like *Aedes albopictus*, expanding the range of potential vector-borne diseases affecting equines in Europe.

A comprehensive mosquito control system for equine farms consists of multiple integrated approaches that target mosquitoes at different life stages, adapted to European climates, regulations, and mosquito species. This system combines environmental management, biological controls, physical barriers, and targeted chemical applications when necessary.



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Environmental Management:

- Water management systems compliant with EU water management directives to eliminate breeding sites.
- Proper drainage solutions for paddocks and surrounding areas.
- Regularly emptied and cleaned water troughs (at least twice weekly).
- Aeration systems for ponds and water bodies to prevent stagnation, particularly important in temperate European climates where seasonal temperature changes affect water quality.

Physical Measures:

- Fine-mesh screening systems for stables and shelters (1.0-1.5mm mesh) designed for European building regulation.
- Horse-specific protective gear including fly masks, sheets, and leg wraps with insect proof material suitable for both Mediterranean and northern European climates.
- Mosquito traps utilizing CO₂ technology without UV light.

Biological Controls:

- Apply measures to maintain wildlife insectivorous species, that are effective mosquito predators (bats, birds, terrapins and other species).
- Targeted larvicide applications using *Bacillus thuringiensis israelensis* (Bti) in compliance with European organic farming standards. Around 40€/Kg.

Strategic Chemical Applications:

- Residual barrier treatments for building exteriors using only EU-approved biocides with appropriate registration.
- Spot-treatment protocols aligned with the European Sustainable Use of Pesticides Directive (2009/128/EC).

The system adapts to various European regional conditions, from Mediterranean areas with longer mosquito seasons to Northern European locations with shorter but intense mosquito activity periods.

In summary, reasons for implementing this solution in European contexts:

- Addresses increasing incidence of vector-borne diseases in European equine populations due to climate change.
- Complies with EU regulations on animal welfare and disease prevention.
- Aligns with EU Green Deal objectives for sustainable agricultural practices.
- Decreases veterinary treatment costs associated with these diseases.
- Protects valuable European sport horse and breeding populations.
- Contributes to national surveillance systems for vector-borne diseases.
- Provides sustainable alternatives to constant chemical application in line with EU environmental policies.



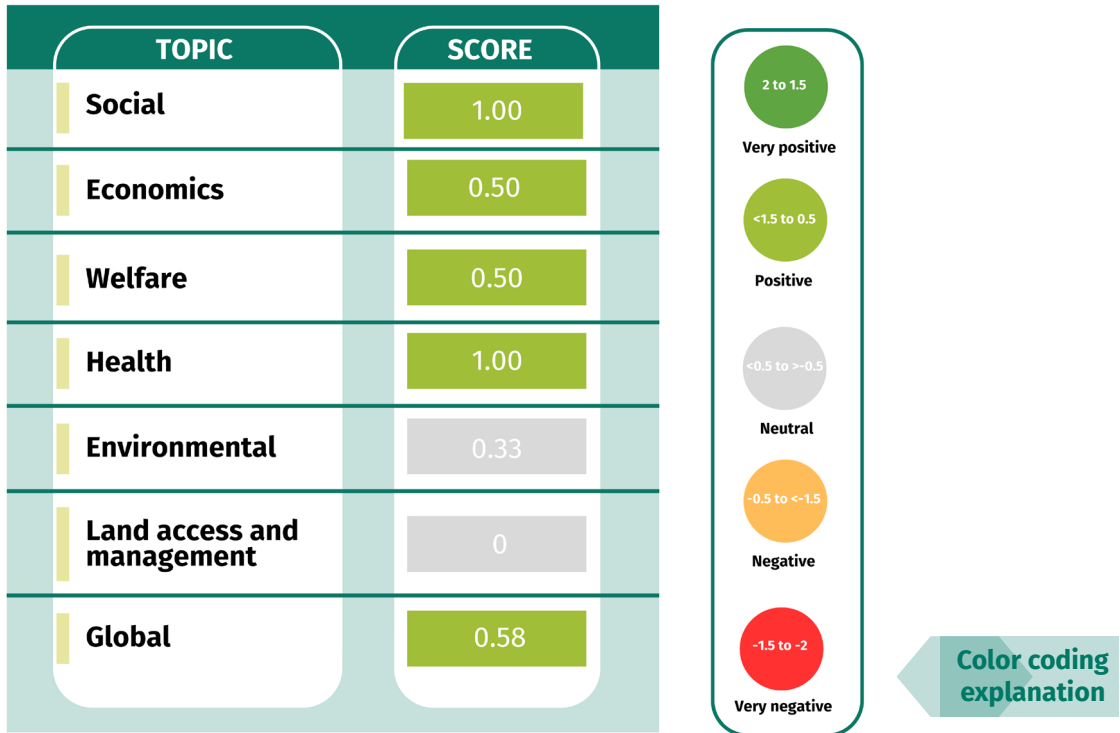
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Implementation Steps

1. Professional assessment of the property to identify mosquito breeding sites, high-risk areas, and optimal locations for control measures.
2. Development of a customized implementation plan based on facility size, location, local mosquito species present in the region, and compliance with national regulations.
3. Initial environmental modifications (drainage improvements, elimination of standing water, vegetation management) in accordance with local water management regulations.
4. Installation of physical barriers and biological control systems (Bti).
5. Staff training on maintenance protocols, monitoring procedures, and supplementary control measures including awareness of EU regulations on biocide use.
6. Establishment of ongoing monitoring system to evaluate effectiveness and make seasonal adjustments.

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How Will this Solution Impact the Performance of your Farm ?



Socioeconomics: This solution will support the social performance of the farm because it enhances the farm’s image and credibility by demonstrating proactive and responsible animal health management.

This solution will support the economic performance of the farm because preventive measures help avoid high disease-related costs, which often exceed the investment required to implement them.



Health & Welfare: This solution will support the farm’s health performance by reducing the risk of mosquito-borne diseases and the potential mortality of horses. It will also positively impact welfare performance by protecting the animals from mosquito harassment, thereby improving their overall comfort and well-being.



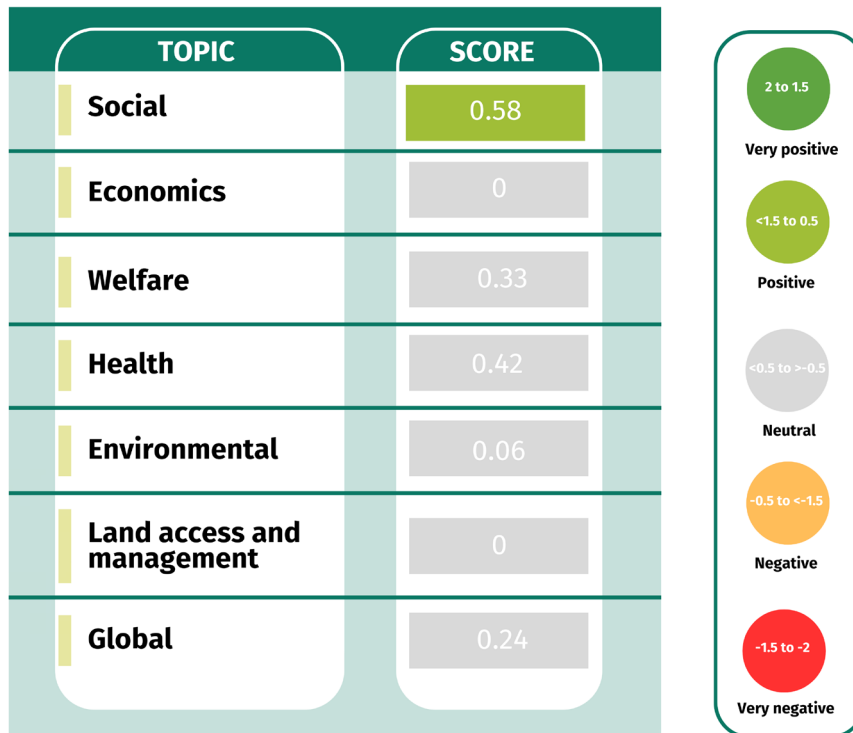
Environmental Sustainability: This solution will not have effect on the environmental performance of the farm. However, it can be noted that water management systems and proper drainage solutions are direct ways to contribute with water management.

This solution will not have effect on the land access or management performance of your farm because there is not evident direct impact.

Globally, this solution will support the performance of your farm.

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How Will this Solution Impact the Resilience of your Farm?



Socioeconomics: This solution will not impact social performance of the farm facing external challenges assessed because it improves health and welfare of horses, and working conditions, aligns with EU regulations, and is positively perceived by the public, especially when integrated as part of a broader, preventive mosquito control strategy.

This solution will not impact economic performance of the farm facing external challenges assessed because its implementation and maintenance—especially during inflation or pandemics—can lead to increased costs due to rising prices of CO₂ and larvicides, and potential supply chain disruptions.



Health & Welfare: When the farm faces external challenges, its health performance may be slightly supported by this solution, as it helps reduce pain, mortality, and the need for medication by preventing the transmission of insect-borne infectious diseases.

While the solution does contribute positively to welfare performance, the effect is minimal when addressing external challenges across all three thematic areas. Its primary relevance lies in mitigating health and welfare risks associated with the potential transmission of West Nile Virus by mosquitoes. However, it does not have a direct impact on socio-economic or environmental sustainability challenges.



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How Will this Solution Impact the Resilience of your Farm?



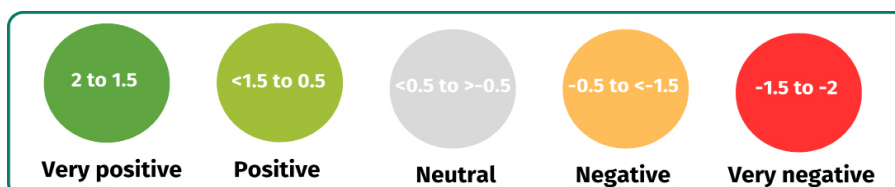
Environmental Sustainability: This solution will not impact environmental performance of the farm facing external challenges assessed because there is no direct effects on environmental sustainability, except positive effect on water management in a case of extreme weather challenge.

This solution will not impact land access or management performance of the farm facing external challenges assessed because there is no direct effects.

So globally this solution will not impact the global resilience of the farm facing the challenges assessed.

How Can this Solution Help your Farm Cope with Specific External Challenges to Become More Resilient?

CHALLENGES	SCORE
Inflation	-0.08
Pandemic	0
High welfare standards	0.33
High infectious diseases	0.42
Extreme weather event	0.67
Loss or limited access to grassland	0.08



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How Can this Solution Help your Farm Cope with Specific External Challenges to Become More Resilient?



Inflation & Social Crises: This solution will not impact the global performance of the farm facing inflation because although the prices of CO₂ and larvicides may rise, these increases would have only a slight negative effect and are unlikely to compromise the overall functioning or resilience of the farm.

This solution will not impact the global performance of the farm facing pandemics because while CO₂ supply chains may be disrupted and costs could increase, these effects remain marginal and are counterbalanced by positive aspects as, for example, a stronger public support for preventive health measures, induced by the pandemic, maintaining the farm's stability and reputation.



Welfare & Diseases: This solution offers limited support for the farm's overall performance across all three areas when facing infectious disease challenges. Its main contribution lies in reducing pain, mortality rates, and disease incidence through environmental management, biological controls, physical barriers, and targeted chemical applications that disrupt insect biological mechanisms. However, its impact from a socio-economic perspective is minimal.

When adapting to compulsory high welfare standards, the solution is neutral regarding the farm's overall performance. While it does not significantly enhance farm management or maintenance practices, it may help reduce insect harassment, which can contribute to a more positive emotional state in the animals.



Climate Change & Access to Land: This solution will support the global performance of the farm facing extreme weather events. related to abnormally low temperatures, excessive raining, windstorms, and floods. These positive effects relate especially to socio-economic aspects, animal welfare and health, and water management- This solution's positive performance would even better positive performance score would be enhanced in a scenario in which higher temperatures and excessive rain would benefit the vector. Water management and proper drainage involved in this solution can have a bigger impact on this challenge.

This solution will not impact the global performance of the farm facing loss or limited access to agricultural land because not much direct effects. However, the solution has positive effect on social outreach, as the image of the farm can be improved by using it.

So this solution will support the farm resilience facing extreme weather event only.

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Cost-Benefit Analysis

Costs

Socioeconomics:

- **Substantial initial investment**, especially challenging for smaller farms (e.g., drainage systems, physical barriers, CO₂ mosquito traps).
- **Maintenance costs** for physical measures such as regular cleaning and repair of fine-mesh screens, mosquito traps, and protective gear.
- **Costs related to adapting protective gear for horses** (fly rugs, masks) to different climatic conditions (e.g., breathable mesh for hot Mediterranean climates).
- **Ongoing maintenance** of gear and physical barriers to ensure effectiveness and comfort.
- **Regional adaptation costs** due to different mosquito species and climate zones (longer seasons in Mediterranean vs. shorter but intense in Northern Europe).
- **Coordination efforts** with local authorities, particularly near protected natural areas or overlapping land uses.

Health & Welfare:

- **Possible adverse reactions** from chemical applications (spot-on treatments, residual insecticides), such as skin irritation or allergic responses.
- **Stress from repeated handling** for application of repellents or wearing protective gear.



Benefits

- **Reduced veterinary expenses** by lowering incidence and treatment costs of vector-borne diseases.
- **Less labor downtime** due to healthier horses and decreased insect-related stress for stable staff.
- **Long-term cost savings** through sustainable, chemical-reducing methods.
- **Contribution to the economic viability** of the European equine industry (breeding, sports, tourism).



- **Significant reduction in mosquito bites** leading to less stress and better rest, improving immune function.
- **Lower risk of serious diseases** such as West Nile Virus, Equine Infectious Anemia, Usutu virus, and others.
- **Improved quality of life and performance** for sport and breeding horses.

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Cost-Benefit Analysis

Costs

Health & Welfare:

Environmental Sustainability:

- **Potential negative impacts from pesticide use** (even EU-approved biocides).
- Harm to non-target organisms such as pollinators, aquatic insects, amphibians.
- Accumulation of chemical residues in soil and water bodies.
- Risk of mosquito resistance development.
- **Reduction in biodiversity** if chemicals are not applied carefully.
- **Interference with sensitive ecosystems** near protected natural habitats.
- **Monitoring and mitigation efforts** to ensure minimal environmental harm.

Cooperation between farms :

- **Need for coordination and communication** between neighboring farms, breeding centers, and riding facilities.
- **Disparities in investment capacity** potentially leading to uneven implementation among different-sized operations.



Benefits

- **Potentially reduced direct chemical exposure** on animals, minimizing potential toxic side effects.



- **Potentially decreased pesticide application**, supporting beneficial insect populations and overall ecosystem health.
- **Promotion of natural mosquito predators** (bats, birds, terrapins) by preserving or enhancing habitat quality.
- **Compliance with EU pesticide sustainability directives** (e.g., 2009/128/EC) and Green Deal objectives.
- **Supports biodiversity and long-term ecological balance** on and around horse farms.



- **Synergies from regional cooperation**, such as shared mosquito monitoring, training, and equipment use.
- **Improved regional disease surveillance and early warning** through coordinated data collection.
- **Standardization of animal health and environmental practices** across the equine sector.

Cost-Benefit Analysis

Costs

Cooperation between farms:



Benefits

- **Strengthened local networks** promoting knowledge exchange and mutual support.

Additional Resources

Websites

- <https://vetmedcare.net/en/collections/pferdeprodukte/> Horse-specific protective gear
- https://www.decathlon.pt/p/cobrejao-antimoscas-de-equitacao-cavalo-e-ponei-100-cinzeno/_/R-p-176911?mc=8645849&utm_source=google&utm_medium=cpc&utm_campaign=pt_t-perf_ct-shopp_n-nonbrand_f-cv_o-roas_gad_source=1&gclid=Cj0KCQiA2oW-BhC2ARIsADSIAWotLE_m1WeMLkFnZSwFYy38Ib_DdGp0wwJ8_RLNXS3DH3IENi45pWEaAq7jEALw_wcB (Amigo Bug buster)
- https://extension.umd.edu/sites/extension.umd.edu/files/2021-03/FS791_GotBugs_GetBats.pdf
- <https://sea.biogents.com/mosquito-traps/bg-mosquitaireco2/>
- <https://www.mosquito-traps.eu/product/amt200-with-co2-boosterkit>

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- Land, M., Bundschuh, M., Hopkins, R.J. et al. Effects of mosquito control using the microbial agent *Bacillus thuringiensis israelensis* (Bti) on aquatic and terrestrial ecosystems: a systematic review. *Environ Evid* 12, 26 (2023). <https://doi.org/10.1186/s13750-023-00319-w>



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Ideas to Ideas to Animate a Workshop about the Solution

- **Sponsor:** Ask a company specialized in animal health products, equine husbandry, or sustainable farm management to sponsor the workshop.
- **Venue:** Find a horse farm or equestrian center with existing mosquito control measures or willing to host a demo setup.
- **Tasks for Participants:** Prepare practical tasks like identifying mosquito breeding sites, setting up traps, or installing mesh screens for participants to try.

Proposed structure for the workshop on Integrated Mosquito Control System in Equine Stables

1. Introduction to the Integrated Mosquito Control System

- What is an integrated mosquito control system?
- Key components: environmental management, biological controls (Bti, predators), physical barriers (fine-mesh screens, protective gear), and selective chemical use.
- Types of mosquito control products available on the market (e.g., CO₂ traps, larvicides, insect-proof materials).

2. Benefits of Mosquito Control Systems in Equine Stables

- Reduced disease risk for equines (WNV, EIA, African Horse Sickness).
- Less stress and irritation for horses and improved welfare.
- Reduced need for chemical pesticides → better for the environment.
- Cost savings on veterinary treatments and labor.
- Enhances working conditions for stable staff.

3. Practical Applications on Equine Farms

- Environmental management: eliminating standing water, pond aeration.
- Installing physical barriers: fine-mesh screens on stable windows and doors.
- Use of biological controls: applying Bti larvicide safely in water bodies.
- Spot chemical treatments following EU regulations.
- Use of protective horse gear: fly masks, sheets, leg wraps.

4. How to Choose the Most Suitable Mosquito Control Approach

- Assess farm's mosquito problem and regional mosquito species.
- Consider climate zone (Mediterranean vs Northern Europe).
- Evaluate stable infrastructure for physical barriers.
- Decide on combination of environmental, biological, physical, chemical controls based on regulations and farm resources.
- Compare product quality, costs, and ease of use.



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5. Hands-On Demonstration

- Participants identify potential mosquito breeding spots on the farm.
- Demonstrate setting up a CO₂ mosquito trap.
- Show how to properly fit protective fly masks and fly rugs
- Practice applying Bti larvicide (using safe demo formulations).
- Inspect and clean fine-mesh screens.

6. Maintenance and Troubleshooting

- How to maintain and clean traps and screens regularly.
- Monitoring mosquito populations and breeding sites.
- Troubleshooting common problems: damaged screens, ineffective traps, larvicide resistance.
- Guidelines on safe handling and storage of larvicides and biocides.

7. Case Studies and Real-World Examples

- Present examples of European farms successfully using integrated mosquito control.
- Share before/after health data and mosquito counts.
- Lessons learned: managing seasonal variations, cost-benefit balance.
- Testimonials from farm owners and vets.

8. Cost Analysis and Return on Investment (ROI)

- Initial costs for environmental changes, barriers, biological agents.
- Ongoing maintenance and seasonal adaptation costs.
- Savings from reduced veterinary bills and improved horse performance.
- Calculation examples based on farm size and regional mosquito pressure.
- Financial benefits aligned with EU animal welfare and pesticide regulations.

9. Q&A Session

- Open discussion for questions about specific control measures or regulations.
- Address concerns about costs, animal safety, and environmental impacts.
- Share tips for small vs large farms.

10. Wrap-Up and Resources

- Summary of integrated mosquito control benefits and steps.
- Handout with supplier contacts, EU regulation references, and maintenance checklists.
- Information on possible grants or subsidies for sustainable pest control.
- Contact details for follow-up support or consultancy.