Technical Sheet for Solution Implementation

Climate-resilient Grass and Legume Species Selection for Pastures

Thematic area: Environmental Sustainability.

Priority: How to manage grassland in the face of the future challenges?

Need: Forage production: how to limit the effects of climate change on the quality and quantity of forage?

Solution EU number: GM-04.

Content of the solution: New seed varieties that can cope with climate change and new and extreme weather conditions, ensuring stable forage production and pasture resilience under changing environmental conditions.

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Reasons for Implementing the Solution

Equine farms need to adapt to increasing climatic variability by introducing grass and legume varieties that are resilient to extreme weather conditions and well adapted to local soil and climate. Climate-resilient species can improve long-term pasture productivity and reduce dependency on high-input, high-yield varieties that are more vulnerable to droughts and floods.

Description of Solution Strategies

Pastureland for horse grazing is often based on grass–legume mixtures that improve soil health, nitrogen fixation, and soil carbon storage. Plants must be resilient to grazing (trampling) as well as to climatic stressors. Equine farms using rotational grazing typically favour long-lasting pastures and, where possible, farm-based seed production.

Species diversity within grass–legume mixtures increase functional stability of the sward, as different plants respond differently to drought, heavy rainfall, and temperature fluctuations. Deep-rooting species improve drought resistance, while fast-establishing species support rapid regrowth after grazing or cutting. This diversity helps to reduce production risks and stabilise forage availability over time.

Novel, exotic, and underutilised plant species may become increasingly important to maintain year-round forage availability under changing climate conditions. These species can help stabilise forage supply and increase system resilience. In addition, their integration requires adaptive management strategies, as species composition may shift over time depending on soil fertility, climate conditions, and grazing pressure.

Stocking rates must be adapted to pasture productivity, season, and climatic conditions. Typical ranges vary depending on pasture quality, but stocking density should be reduced in summer or dry periods to prevent pasture degradation. Continuous presence of equines on the same pasture can lead to overgrazed patches and bare soil, promoting the spread of undesirable plant species.

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Implementation Steps

1. Assessment of farm needs
- Evaluate forage demand and current pasture performance.
- Assess existing grassland composition and condition.
- Seek advice from local agricultural advisory services or cooperatives.

2. Prioritisation of farm objectives
- Define production goals (yield, quality, resilience, longevity).
- Identify priority areas for pasture improvement or renewal.

3. Selection of suitable species and traits
- Performance: exotic legumes (e.g. Hedysarum coronarium) and minor species with high biomass production.
- Nutritional value: species with good digestible protein levels and high organic matter content.
- Resilience: stress-tolerant forbs (e.g. Cichorium intybus, Achillea millefolium) and legumes.
- Trampling resistance and persistence for rotational grazing systems:
  - Festuca rubra.
  - Agrostis capillaris.
  - Festulolium (hybrid Festuca × Lolium).

4. Soil and site analysis
- Analyse soil parameters (N, P, K, Mg, Ca, pH).
- Match species selection to soil fertility and structure.
- Adjust mixtures to local climate conditions.

5. Climate adaptation considerations
- Select drought-adapted species (e.g. Bituminaria bituminosa, Hedysarum coronarium, Trifolium tumens, Medicago lupulina).
- Match species choice to rainfall patterns and temperature extremes.

6. Establishment of pasture
- Decide between reseeding or overseeding depending on soil condition.
- Prefer overseeding where possible to minimise soil disturbance.
- Use conservation practices such as minimum tillage and direct seeding.

7. Initial pasture management
- Perform first mechanical cut before grazing.
- Ensure plants reach 7–10 cm before first use.
- Allow root systems to establish before animal access.

8. Monitoring and adjustment
- Evaluate pasture development over time.
- Adjust species mix if needed based on performance and climatic response.

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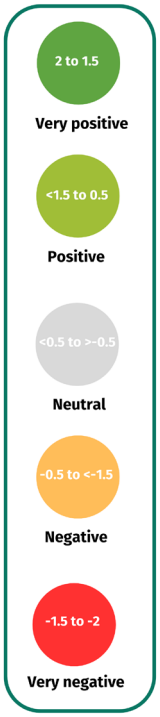
How Will this Solution Impact the Performance of your Farm?

TOPIC	SCORE
Social	0
Economics	0
Welfare	0.50
Health	0
Environmental	0.67
Pasture access and management	1.00
Global	0.33



Traffic light explanation

Socioeconomics: This solution will not have effect on the social performance of the farm because the introduction of climate-resilient grass and legume species mainly affects pasture management rather than the organisation of social or working conditions on the farm. However, the use of less familiar species or varieties may require communication and education efforts toward horse owners, as innovative pasture approaches are not always immediately well accepted. This solution will not have effect on the economic performance of the farm because the strategy mainly aims to improve long-term pasture resilience and forage stability under climatic stress rather than generating immediate economic gains. Certain resilient species such as chicory can improve drought resistance and grazing persistence, either in diversified mixtures or monospecific pastures, but their benefits depend on local conditions and management practices.

Health & Welfare: This solution will support equine welfare performance by promoting positive emotional states and providing welfare-friendly conditions. Grazing is one of the most highly motivated and preferred behaviours in horses and prevents the development of oral stereotypies. Moreover, group grazing plays an important role in meeting animals' social needs by providing opportunities for social bonding and support. Continuous access to pasture and unrestricted locomotor activity further contribute to positive welfare outcomes. Access to pasture areas that would otherwise be unavailable due to insufficient grass growth increases opportunities for choice and agency, allowing horses to interact with and exert control over aspects of their environment. These opportunities contribute to positive welfare and an optimal mental state.

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This solution will have a neutral effect on the farm's health performance because it does not directly contribute to reducing pain, mortality, or drug use. However, grazing generally has a positive effect on equine health, as it allows animals to engage in locomotor activity. Allowing horses to spend longer periods outdoors may also contribute to a lower incidence of respiratory disorders. The quality and botanical composition of the pasture should be monitored to prevent health issues in equines.

Environmental sustainability: This solution will support on the environmental performance of the farm because selecting drought-tolerant species such as chicory and sorghum supports adaptation by maintaining vegetation cover during dry periods and ensuring forage availability. Continuous plant cover also contributes to soil carbon storage and lowers energy use, and this way support climate change mitigation and adoption. Chicory and similar species provide structural and nutritional diversity compared to conventional ryegrass-dominated systems. However, the biodiversity gains are generally greater in diversified grasslands than in monospecific systems. This strategy does not aim to introduce novel species, but rather to reintegrate known but underused species, supporting agroecosystem diversity and resilience. Water-use efficiency is an advantage of this solution. Deep-rooting plants enhance soil water extraction capacity, reduce reliance on irrigation, and improve soil structure and infiltration over time.

This solution will support on the land access or management performance of the farm because climate-resilient species can improve marginal grassland usability, enabling grazing on soils previously limited by drought stress. Some items should be taken into account in planning and land management; grazing timing and intensity must be adapted to plant species characteristics. Some species may raise toxicity risks. For instance, sorghum can present toxic risks to grazing animals, including equines, primarily due to the presence of cyanogenic glycosides. The content of theses varies with the growth stage and environmental conditions of the crop. Using climate-resilient grass and legume species aligns with practical farm-level decision-making, but it requires careful planning and implementation.

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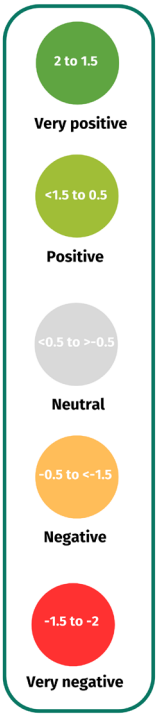
How Will this Solution Impact the Resilience of your Farm?

TOPIC	SCORE
Social	-0.25
Economics	0.42
Welfare	0.75
Health	0.33
Environmental	0.22
Pasture access and management	0
Global	0.26



Socioeconomics: This solution will not impact social performance of the farm facing external challenges assessed because climate-resilient pasture species mainly influence forage production and grassland management rather than the farm's social organisation. While improved forage availability can reassure horse owners and support animal welfare during droughts or feed shortages, implementation may require additional workload, technical management, and communication efforts, especially when introducing unfamiliar forage species that may raise concerns among clients.

This solution will not impact economic performance of the farm facing external challenges assessed because the benefits mainly concern long-term forage resilience and feed autonomy rather than immediate economic gains. More resilient grasslands can reduce dependence on purchased hay, irrigation, and external feed resources during droughts or inflationary periods, and may improve pasture productivity and fodder security. However, these advantages can be offset by higher seed costs, additional management requirements, possible increases in fuel or maintenance costs, and the fact that the solution becomes less effective when grazing land access is strongly reduced.

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Health & Welfare: This solution does not directly support the farm's health performance, as pasture composition does not directly reduce pain, mortality, or the need for medication when the farm is exposed to external pressures such as staff shortages, reduced farm income, or water shortage. Nevertheless, prolonged access to pasture enriched with resilient plants, may help maintain horses in good health and body condition, thereby supporting their ability to cope with external challenges.

This solution will have a positive effect on farm welfare performance, as it promotes positive emotional states in horses, even under conditions of external pressure. Pastured animals are in good mental state, allowing farmers to better cope with other farm-related challenges. Consequently, the implementation of this solution may strengthen farm resilience and improve its capacity to withstand and adapt to external pressures.

Environmental sustainability: This solution will not impact environmental performance of the farm facing external challenges assessed despite of the fact that has small positive impact if farm faces extreme weather event, inflation or pandemics because used plants are adapted to climate change and this has positive effect on water management due to less need of irrigation and use of water resouces. These effects depend management systems on the farm.

This solution will not impact land access or management performance of the farm facing external challenges assessed because as its effects are twofold and depend on the specific challenge. For example, in situations such as inflation or extreme weather events, the solution can have a positive effect by supporting more resilient field management and providing additional fodder. Conversely, in cases such as pandemics or high welfare requirements, it may have negative or even very negative impacts due to a reduced labour force or the need to reallocate land from crop production to grazing or paddocks. If a farm face lost or limited access to grassland, the solution is largely neutral, as it does not address the underlying cause of the issue.

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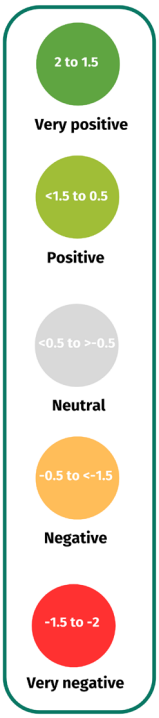
How can this solution help your farm to face specific external challenges to be more resilient?

CHALLENGES	SCORE
Inflation	0.33
Pandemic	-0.08
High welfare standard	0.08
High infectious diseases	0.08
Extreme weather event	1.17
Loss/limited access to grassland	0



Inflation & Social Crises: Social challenge: This solution will not impact the global performance of the farm facing pandemics because climate-resilient pasture species mainly strengthen forage autonomy and long-term grassland adaptation, while pandemics primarily affect labour availability, customer activity, and farm organisation. Although better feed self-sufficiency can slightly support continuity of horse care during disruptions, the solution itself has limited direct influence on the farm's social resilience.

Economic challenge: This solution will not impact the global performance of the farm facing inflation because resilient grass and legume species can improve forage stability, reduce irrigation needs, and partially decrease dependence on purchased feed, but these benefits are balanced by additional seed, management, and implementation costs. The solution mainly provides long-term adaptation to climatic variability rather than direct protection against rising prices and inflationary pressures.

Welfare & Diseases: Health challenge: This solution has a neutral effect on the global performance of the farm across the three sustainability dimensions when facing an infectious disease challenge. Socioeconomic, environmental, and animal health and welfare objectives may be difficult to achieve if the farm experiences a sudden outbreak of infectious disease. Although well-adjusted pastures can support good nutritional status and general health, they are unlikely to be sufficient to mitigate the consequences of an infectious disease outbreak.

Welfare challenge: Similarly, this solution does not significantly affect the global performance of the farm when facing the implementation of high-standard animal welfare legislation. Access to pasture is a fundamental requirement from an equine welfare perspective, and the duration of pasture access is often more important than pasture quality alone. However, if extended pasture access can be combined with the provision of high-quality, well locally adjusted pasture, this solution may contribute to greater farm resilience and facilitate compliance with higher welfare standards.

Climate Change & Access to Land: Environmental challenge: this solution will support the global performance of the farm facing abnormally high temperatures or/and draught because it's fodder production helps reassure customers and horse owners by ensuring a reliable feed supply, though it can increase workload and add pressure to daily operations. The supports profitability by enabling fodder production even during drought conditions and may also create opportunities to sell surplus feed. Additionally, grasslands remain suitable for grazing even in dry periods, helping to preserve farm capital. Reliable access to fodder contributes to better maintenance and provides better well-being also for farmers. Allowing horses to graze during drought conditions also promotes their health. Furthermore, this approach requires less water for both fodder production and maintaining grazing areas, while improving the resilience of pastures and overall land management.

Land access/management challenge: this solution will not impact the global performance of the farm facing loss or limited access to agricultural land because if the farm loses pastures/meadows/fields, the solution is no longer applicable and therefore cannot meet the challenge.

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Cost-benefit Analysis

Costs

Socioeconomics:

- Purchase of seeds (costs vary depending on species mix and quality)
- Investment in equipment (tractor, seeding machinery) or membership in cooperatives for shared machinery use.
- Training and advisory costs for pasture establishment and management.
- Soil analysis and agronomic consultancy costs.
- Establishment costs for new or reseeded pastures (including labour, machinery, fuel).
- Average establishment costs: approx. 1500–3000 €/ha (farm self-managed) and 2500–6000 €/ha (contractor-based), depending on farm size and contractor use (small plots <5 ha often relatively more expensive).
- Possible additional costs for fencing adaptation or replacement.
- Temporary reduction in usable pasture area during establishment phase.
- Exclusion period of approximately 75–90 days after reseeding before grazing is possible.
- Time requirements for planning, establishment, and coordination.

Health & Welfare:

- Certain plant species or varieties may be toxic in specific conditions or growth stages.
- Temporary loss of grazing access during establishment period (75–90 days).
- Risk of limited pasture availability during reseeding phases

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Benefits

- More efficient and productive use of pastureland.
- Higher forage yields and improved feed availability.
- Reduced long-term feeding costs due to higher self-sufficiency.
- Potential surplus forage production enabling sale of hay or pasture products.
- Improved resilience to weather extremes reduces economic risk.
- Shared resources and contractor use can reduce individual investment costs.
- Improved farm image and potential increase in social acceptance.
- Participation in cooperatives can improve access to subsidies and funding schemes.

- Increased grazing time once established due to improved pasture productivity.
- Increased overall animal health and condition.

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Costs

Environmental Sustainability:

- Risk of soil disturbance during seeding or reseeding operations.
- Potential soil compaction from heavy machinery use.
- Temporary erosion risk during early establishment phase.

Cooperation between Farms:

- Time-consuming coordination and partner identification.
- Contractual and administrative workload (agreements, documentation).
- Potential conflicts over resource allocation (machinery, labour, water use).
- Need for structured planning and communication between farms.
- Possible disagreements on timing depending on weather conditions.

Benefits

- Increased plant biodiversity in grassland systems.
- Improved habitat for insects and associated biodiversity (e.g. dung beetles).
- Enhanced soil organic carbon sequestration and biological nitrogen fixation.
- Improved natural weed suppression.
- Better ground cover persistence, even under drought conditions.
- Reduced need for irrigation due to improved resilience.

- Access to shared machinery and technical expertise.
- Reduced individual costs through joint investments and cooperatives.
- Shared costs for soil analysis and advisory services.
- Access to subsidies and rural development funding through cooperative structures.
- Exchange of knowledge and best practices between farms.
- Improved market access through collective production volumes.
- Reduced transport costs through coordinated logistics.
- Strengthened regional cooperation and resource efficiency.

Additional Resources

Videos

- Warm Season Grasses for Forages: https://youtu.be/fbkv5eHw1Zs?si=rlTt9dYUzjk8dr8V

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Climate-resilient grass and legume species selection for equine pastures *Annex*

Ideas to Animate a Workshop About the Solution

- Involve relevant stakeholders such as advisors, cooperatives, or companies specialising in grassland management, equine nutrition, or agricultural advisory services as potential supporters or sponsors of the workshop.
- Identify a suitable demonstration or model farm where the workshop can be hosted under practical field conditions.
- Include practical tasks and demonstrations, allowing participants to actively engage with the system and gain hands-on experience with its application in real farm settings.

Proposed Structure for the Workshop on Multi-Species & Climate-Resilient Grasslands in Equines Farms

1. Introduction to the Solution
- What are multi-species and climate-resilient grasslands?
- Basic concept: grass–legume mixtures adapted to local soil and climate conditions.
- Why species diversity is increasingly relevant under climate variability.
- Overview of different grassland types (temporary vs. permanent systems).

2. Benefits of the Solution in Equine Farms
- Improved stability of forage production under variable weather conditions.
- More flexible grazing and mowing systems.
- Better use of natural pasture resources and reduced reliance on external feed sources.
- Increased system resilience through species diversity.
- Support of more continuous forage availability across the season.

3. Practical Applications on Equine Farms
- Integration into grazing and rotational grazing systems.
- Use in mixed mowing–grazing systems.
- Adaptation of pasture design to horse-specific grazing behaviour.
- Use of multi-species mixtures in pasture renovation and reseeding strategies.
- Combination of grasses and legumes adapted to different soil zones within one farm.

4. How to Choose the Most Suitable System
- Assessment of farm-specific needs (feed demand, stocking density, management system).
- Soil and climate analysis as basis for species selection.
- Selection of appropriate grass–legume mixtures depending on:
  - grazing vs. mowing use.
  - soil fertility and structure.
  - drought and stress exposure.
- Consideration of long-term persistence and management intensity.

5. Hands-On Demonstration
- Field walk: identification of different grass and legume species.
- Demonstration of pasture condition assessment (density, diversity, sward structure).
- Comparison of different pasture types (improved vs. diverse systems).
- Practical exercise: evaluating pasture suitability for horses.

6. Maintenance and Management
- Monitoring of species composition over time.
- Adaptive management depending on grazing pressure.
- Overseeding and reseeding techniques.
- Seasonal pasture management strategies.

7. Case Studies and Real-World Examples
- Examples of farms using multi-species grassland systems.
- Experiences with pasture resilience under drought or heavy rainfall.
- Practical lessons from rotational grazing systems.
- Farmer feedback on management challenges and benefits.

8. Cost and Resource Considerations (ROI-oriented)
- Overview of establishment and management effort.
- Importance of planning, advisory support, and long-term perspective.
- Role of cooperation in reducing individual workload and improving efficiency.
- Value of system resilience in reducing production risk over time.

9. Q&A Session
- Open discussion on practical challenges and farm-specific adaptation.
- Exchange of experiences between participants.
- Clarification of implementation strategies.

10. Wrap-Up and Resources
- Key take-home messages.
- Further reading and advisory contacts.
- Available support structures (cooperatives, advisory services, regional programs).
- Next steps for farm implementation.