SUPER-G
SUSTAINABLE PERMANENT GRASSLAND

MEDITERRANEAN
BOREAL
ALPINE
PANNONIAN
CONTINENTAL
ATLANTIC

Introduction of resilient grassland species and distinct cultivars

- **AUTHORS:** Stanislav Hejduk, Paul Newell Price, David Patterson and Jason Rankin

- **DESCRIPTION:** Among the new species commonly used in grasslands we include intergeneric hybrids Festulolium, as well as chicory, plantain, sainfoin and bird's-foot trefoil. The main advantage of these species are their drought and heat tolerance, high palatability, lower demand for nutrients and contribution to soil fertility.

Among distinct cultivars we include more persistent red clovers (Mattenklee). The main advantage is their longer persistence compared to standard varieties (Table 1).

Table 1: A list of the novel species and cultivars used for permanent grasslands establishment, renovation and overseeding

English name	Scientific name	Example of varieties
Festulolium (tall fescue x Italian ryegrass)	xFestulolium krasanii (syn. F. braunii)	Ryegrass type: Lofa, Tatran Tall fescue type: Hykor, Mahulena, Hipast, Fojtan
Festulolium (meadow fescue x Italian ryegrass)	xFestulolium pabulare	Achilles, Perun, Perseus, Aberniche,
Festulolium (meadow fescue x perennial ryegrass)	xFestulolium loliaceum	Prior
Chicory	Cichorium intybus L.	Grassland Puna, Puna II, Choice, Spada
Plantain	Plantago lanceolate L.	Ceres Tonic
Sainfoin	Onobrychis viciifolia Scop.	Višňovský, Ambra, Perly, Emyr, Fakir
Bird's-foot trefoil	Lotus corniculatus L.	Polom, Leo,
Mattenklee Red clover	Trifolium pratense L.	Astur, Gregale, Dafila, Carbo

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Fig. 1: Festulolium krasanii (Tall fescue type - on the left), photo I. Houdek; Festulolium krasanii (Italian ryegrass type), photo S. Hejduk

- **RATIONALE:**

All the above mentioned species are naturally present in permanent grasslands, but the development of new cultivars has made these species more valuable for farmers, with higher forage yield and quality compared to wild genotypes. As climate change leads to an increase in the frequency of drought and heat stresses, species and varieties developed for temperate climates often fail. Forage herbs and legumes also provide a forage with high mineral content and legume species such as sainfoin and bird's-foot trefoil can also prevent bloat due to their high tannin content. Furthermore, these species can deliver other ecosystem services more effectively than most grass species, especially in periods of drought or waterlogging, including the possibility of higher rates of carbon sequestration, improved water infiltration, higher ground cover and better support for biodiversity where a diversity of species establishes well.

Fig. 2: Forage chicory (Puna II) and plantain (Ceres Tonic) in pasture sward during drought spells photo S. Hejduk

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- **MECHANISM OF ACTION:**

Festulolium species combine good characteristics of both parents: rapid establishment, high yield and palatability from ryegrass with tolerance to abiotic stresses and persistence provided by fescue. Festulolium cultivars have been developed to help maintain sustainable forage crop production, and through their higher resilience, to provide farmers some security against onsets of climatic stress. Some cultivars have shown an ability to reduce surface runoff and therefore flooding risk.

Forage varieties of chicory and plantain are used mostly in grazing mixtures as they contain up to 90% of water. Both species are not demanding on soil quality and tolerate drought due to deep roots. They are palatable (increased intake) and their forage is rich in minerals.

Sainfoin and bird´s-foot trefoil are legumes (rich in protein) that do not cause bloat due to their tannin content. Both species are persistent and tolerate drought. Their flowers are attractive for pollinators.

Although used primarily in crop rotation, red clover substantially increases forage yield and quality of permanent grasslands. One limiting factor, which constrains its wider use in permanent grasslands, is relatively low persistence. Nevertheless, there are considerable differences in persistence between cultivars, which are caused by diverse adaptability and disease resistance. The cultivars which persist three or more harvest years are called Mattenklee.

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Fig. 3: Sainfoin provides a non-bloating forage (on the left); bird´s-foot trefoil in a pasture sward during a period of drought in August
photo S. Hejduk

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- **POTENTIAL FOR APPLYING THE MANAGEMENT OPTION:**

All the species and cultivars mentioned above can be used as a part of seed mixtures for the establishment of new grassland or can be overseeded into an existing sward. Festulolium (namely the tall fescue type) can replace or complement meadow or tall fescue in seed mixtures. Sainfoin is suitable for stony soils on limestone or chalk bedrock. It establishes and persists better on calcareous soils with high pH. A disadvantage is the high seed rate due to its large seeds (Thousand Seed Weight (TSW) = c. 18 g) and thus high seed cost. Bird´s-foot trefoil is a modest plant thriving on well-drained or shallow soils with a neutral to slightly acidic pH. Once established, it can survive in the sward for a very long time. Despite very small seeds (TSW = 1.0 g) it grows very quickly after sowing.

Red clover can grow rapidly after seeding and its proportion in a mixture for permanent grasslands should not exceed 10 – 15 % (by weight). Increasing the persistence of red clover in a sward would reduce costs for seeding and can have positive effects on yield, carbon sequestration and soil biodiversity.

In the Netherlands and in some other countries and regions in the Atlantic region of Europe, there has been an increased use of these species, but without any significant change in management, e.g. high N inputs and/or high cutting frequencies have been maintained. If legumes are introduced into the stand, nitrogen inputs must be significantly reduced or completely omitted.

Fig. 4: Differences in red clover varieties persistence (non-persistent variety on left and persistent variety Astur in the 4th harvest year); root rot is the main reason for low red clover persistence
photo S. Hejduk

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- **SUPPORT:**

In general, no external incentives are needed. The costs associated with incorporating novel species into new or existing swards (overseeding) can be covered by higher forage production and livestock performance. However, some agri-environment schemes (e.g. the Sustainable Farming Incentive in England) do provide incentives for the introduction of multi-species swards.

- **EXAMPLE OF GOOD PRACTICE (Czech Republic):**

Festulolium cultivars are popular among farmers in central and north-western Europe, especially as a consequence of dry and hot years. Their productivity, forage quality and persistence is appreciated in most European biogeographic regions and many farmers use them as an alternative species for pasture seed mixes instead of pure perennial ryegrass.

Forage chicory (Cichorium intybus) and plantain (Plantago lanceolata) are regular components of many dairy pastures in temperate climates of the world. These species are very popular in New Zealand, South Africa and north-western Europe (i.e. the Atlantic biogeographic region). In recent years they have also been used in central Europe.

Sainfoin and bird´s-foot trefoil are commonly used in southern and central Europe, but due to climate change they are increasingly being used in other parts of Europe. They are popular not just as a forage for ruminants but also for horses as they prevent colic. Farmers are rapidly adapting their grazing and cutting management to improve the persistence of herbs and legumes in the sward. This can include longer grazing intervals and removing livestock when covers are still relatively high.

Mattenklee red clover originated in Switzerland, but in recent years many cultivars have been released (bred) and used throughout Europe. The highest potential use is for overseeding of permanent grasslands, especially in the situations where there is a need for high productivity and quality, and no manufactured nitrogen fertilisers are available or their use is not permitted.

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