

Resilience of grasslands to drought



During a period of drought such as those we have often experienced in recent years, grassland suffers. As well as a drop in grassland yields, there is damage to the grassland base and gaps, and problem plants such as dock and common bluegrass spread. The question is what adaptive measures can and should be taken to maintain productivity.

Overseeding or reseeding is one way of dealing with this problem. Furthermore, by choosing the right varieties and using them correctly, it is possible to sustainably improve grasslands and make them more resilient to future periods of drought.

To sum up:

- In the event of drought, grasses age more quickly than meadows rich in clover and other plants.
- Guaranteed yields thanks to mixed stands rich in grass species, legumes and various plants.
- Overseeding: in patchy meadows (min. 20% gaps in the stand) Choose species suited to the situation and use: Kentucky bluegrass, orchardgrass, meadow fescue, tall fescue, English ryegrass, timothy, red or white clover.
- New sowing: in the event of a high proportion (over 50%) of low-quality grasses Choose species suited to the situation and use: English ryegrass, meadow fescue, orchardgrass, tall fescue, drought-tolerant meadow grass and white clover.
- Many of these species have lower yield potential and lower forage values than English ryegrass, for example. However, if they are established in grassland and periods of drought occur, these more resilient species and varieties can compensate for yield losses. In this way, the available surface area can be put to optimum use, even allowing for the effects of climate change.



Possibilités d'influencer la résilience des prairies

Recommended

- Improve the cover by regular overseeding with suitable grasses (good regrowth = better resilience).
- A proportion of miscellaneous plants (such as dandelion, plantain, meadow-rue, alchemilla, etc.) and legumes in grassland delays the increase in crude cellulose in the event of drought. Grasses age more quickly in drought than grassland rich in clover and other plants.
- Yields are more consistent when species-rich mixtures are used. Mixed stands of grasses, legumes and other plants are more drought resistant than less complex mixtures.
- It is very important to meet the grassland's needs, including potassium and phosphorus.
- The use of nitrification inhibitors during nitrogen fertilisation (in spring) can be a beneficial strategy during dry summers.

Avoid

- Do not mow or graze too deeply (aim for no deeper than 5 - 7 cm), as the grasses store their reserves in the thatch.
- Do not cover a dried-out canopy with thick slurry (additional stress).
- As far as possible, avoid using a currycomb harrow during drought on extensive surfaces.



Grazing advice:

- Adapt the number of animals to the growth of the vegetation.
- Overgrazing during periods of drought weakens the cover by overgrazing. The herd must then be split up or fed in the cowshed.
- If the grass cover has dried out, the animals should be removed entirely from the pasture to avoid lasting damage to the cover.
- In periods of drought, undesirable plants increase. Alternating grazing with other animal species (goats, etc.) may be a solution for some farms.

Opportunities to influence grassland resilience

Targeted grassland improvement requires a systematic approach. To choose the measures to be taken, it is important to analyse the condition of the grassland as accurately as possible. This involves 1) assessing the proportion of holes and 2) estimating the proportion of species.

The aim is to obtain a dense plant stand with :

- 60-80% good grasses
- 10-20% legumes
- 10-20% miscellaneous plants

Overseeding

Where :

- in grassland with holes (at least 20% holes in the stand). → Determination e.g. using the Aulendorf hole detector method (Fig. 1)
- in short stands
- after each weeding operation

How :

- Adapt the choice of seed mix to the site and the intensity of the operation.
- direct drilling = seeds are sown directly through the canopy and deposited in the soil using special seed drills (e.g. disc or tine drills (Fig. 2 top). Direct drilling ensures that the seed is in contact with the soil in drier areas or dense stands. It is characterised by a slightly higher seed quantity and lower repetition frequency.
- Or broadcast sowing = small quantities are sown repeatedly on the surface (Fig. 2 below). Suitable for areas with high rainfall, pastures and very sparse stands. Seeding is carried out using a small centrifugal or pneumatic spreader, a seed drill or special seed drills, which are generally used in combination with a harrow and/or roller. Establish good contact with the soil using a harrow, profiled roller or pasture.

When :

- In wet grassland areas in summer and at high altitude: Immediately after first use until early September.
- In dry regions in summer: most likely after very early initial use (exploiting winter moisture) and in late summer and autumn.

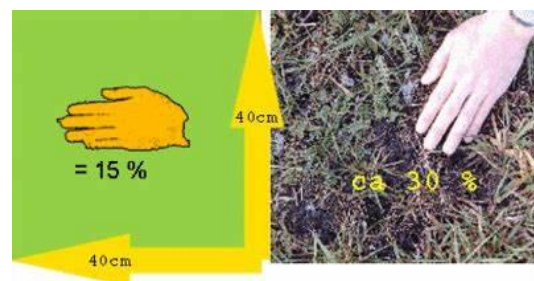


Fig. 1 : Aulendorf hole detector

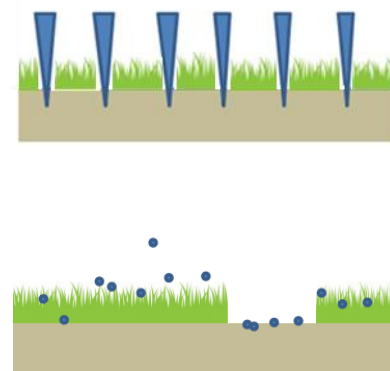


Fig. 2 : Row seeding (top) and broadcast seeding (bottom)

Sowing rate and species:

- 10-20 kg/ha for sowing in rows and 5-8 kg/ha for broadcast sowing
- For seed mixtures with English ryegrass: maximum 1/3 early English ryegrass varieties, maximum 1/3 mid-early varieties and at least 1/3 late varieties. → Do not over-seed with ryegrass only! Adapting to climate change requires a change in species composition!
- For less dense and less intensive stands: overseeding twice a year (2-3 kg/ha) with adapted varieties of Kentucky bluegrass.
- The addition of 1-2 kg/ha of orchardgrass (late varieties) can be positive for the long-term success of overseeding.
- When choosing a new variety (ryegrass, legumes), tetraploid varieties should be preferred to diploid varieties if possible, as they are more stable in the face of climate change.
- Good practical experience has been gained with the regular overseeding of red clover, in order to re-enrich stands managed more intensively with this valuable legume and increase the forage value. This measure should be implemented regularly (every 2-3 years), as red clover is not persistent in the stand. Caution: high nitrogen inputs penalise legumes!
- In the event of drought, grasses age more quickly than meadows rich in clover and other plants. Some of the latter therefore delay the increase in crude fibre in the event of drought.

Example: Overseeding red clover (5 kg/ha) with, for example, Pastor or Milvus varieties increases the drought tolerance of the cover crop. Late summer, before the onset of rainfall, is a good date for over-seeding.

Examples of overseeding mixtures

For more informations : <https://www.eagff.ch/files/images/bilder/Unkraut/PDFs/agff-merkblatt-5.pdf>

Higher altitudes (grazing)	Medium mountain (mixed mowing and grazing)	Plain (mixed mowing and grazing)
30% Tall fescue (<i>Lolium arundinaceum</i>)	30% Kentucky bluegrass (<i>Poa pratensis</i>)	25% Meadow fescue (<i>Festuca pratensis</i>)
25% Kentucky bluegrass (<i>Poa pratensis</i>)	30% Tall fescue (<i>Lolium arundinaceum</i>)	25% Orchardgrass (<i>Dactylis glomerata</i>): late varieties
17,5% Orchardgrass (<i>Dactylis glomerata</i>): late varieties	20% English ryegrass (<i>Lolium perenne</i>): early varieties	15% Timothy grass (<i>Phleum pratense</i>)
15% English ryegrass (<i>Lolium perenne</i>): very early varieties	15% English ryegrass (<i>Lolium perenne</i>): very early varieties	12,5% English ryegrass (<i>Lolium perenne</i>): half-late varieties
5% English ryegrass (<i>Lolium perenne</i>): early varieties	10% Red clover (<i>Trifolium pratense</i>)	12,5% English ryegrass (<i>Lolium perenne</i>): late varieties
5% White clover large leaves (<i>Trifolium repens</i>)		10% White clover (<i>Trifolium repens</i>)
2,5% White clover small leaves (<i>Trifolium repens</i>)		

Opportunities to influence grassland resilience

Reseeding

Where:

Reseeding involves a certain risk of seeding. This is why reseeding should only be carried out where there is a high proportion (over 50%) of poor quality grasses (e.g. couch grass, honey grass, common bluegrass) or undesirable species, or where arable land is being converted to grassland.

How:

- Reseeding after turning over. Caution: Comply with regional regulations prohibiting turning!
- Reseeding after using a rotary tiller or harrow.

When:

- In regions where grass grows well, from May to early September.
- In dry regions in summer and at altitude, most likely in spring.

Sowing rate and species:

- The seed quantity is 25-35 kg/ha.
- Mixtures should be chosen according to the intensity of use targeted and the site conditions. In doing so, attention should be paid not only to the composition, but also to the varieties suited to the site.
- Only drought-tolerant English ryegrass, meadow fescue, orchardgrass, timothy grass and white clover can be used without restriction.
- Plants with different properties can have a positive influence on each other.

Example: Combining English ryegrass (a shallow-rooted, nitrogen-consuming plant) and chicory (a deep-rooted, nitrogen-consuming plant) with drought-tolerant white clover (a shallow-rooted plant) and red clover (a deep-rooted plant) increases yields compared with sowing pure species.

Examples of mixes for reseeding:

Higher altitudes (grazing)	Medium mountain (mixed mowing and grazing)	Plain (mixed mowing and grazing)
25% Tall fescue	25% English ryegrass (very early varieties)	20% English ryegrass (half-early to half-late varieties)
15% Meadow fescue	20% English ryegrass (early varieties)	20% Orchardgrass (late varieties)
10% Orchardgrass (early varieties)	20% Tall fescue	20% Tall fescue
10% Orchardgrass (late varieties)	15% Kentucky bluegrass	15% Meadow fescue
10% English ryegrass (early varieties)	10% Orchardgrass (early varieties)	15% Kentucky bluegrass
10% English ryegrass (very early varieties)	10% Red clover	10% White clover
5% Kentucky bluegrass		
5% Timothy grass		
5% White clover large leaves		
5% Birdsfoot trefoil		

Opportunities to influence grassland resilience

Resilient grasses

- Deep-rooted forage plants can make better use of water reserves and nutrients in deeper soil zones, contributing to greater yield security and stand resilience in times of drought.
- Yield security is higher when species-richer mixtures are used. Mixed stands of grasses, legumes and other plants can cope better with drought than less complex mixtures.
- Some of the species listed below have lower yield potential and forage values than English ryegrass, for example. However, if they are established on grassland and periods of drought occur, these more resilient varieties can compensate for yield losses. In this way, the available surface area can be put to optimum use, even allowing for the effects of climate change.

Drought-tolerant species

Species	Characteristics	Application	Situation
Orchardgrass	<ul style="list-style-type: none"> + Intensively cultivated, evergreen and winter hardy. + Secure yield, especially in dry regions. - If heavily fertilised, repels other plants. - Leaves gaps in the plant cover after its own disappearance. 	Hay meadows Withstands trampling, but cattle avoid clumps.	A wide range of situations
Meadow fescue	<ul style="list-style-type: none"> + Adaptable to most locations. + Has good winter hardiness and tolerates periods of drought fairly well. + High fodder value. - Does not tolerate low cuts. 	Hay meadows, pastures, forage crops. Withstands mowing 3 to 4 times and also grazing that is not too intensive.	Thrives best in nutrient-rich, cool to damp sites, but can also be found in mid-mountain and seasonally dry areas.
Kentucky bluegrass	<ul style="list-style-type: none"> + When well-established, it forms a dense, competitive ground cover and does not allow many weeds to establish (a desirable "filler"). + Very good, high-yielding grass. 	Ideal for intensive use, particularly for grazing, from plains to high mountains.	The main grass that can be used intensively on sites where ryegrass does not grow well.
Red clover	<ul style="list-style-type: none"> + Well suited to silage. - On aeration of hay, stalks dry poorly. When drying on the ground, the rapidly drying partial leaflets remain in place in the form of brittle losses. 	Red clover mixtures can be cut three to five times a year, depending on altitude. Wild forms and "pasture red clover" can be grazed.	Perennial clover (lasting up to 3 years) which, thanks to its taproots, is more robust and productive than white clover in drier areas.
Fromental	<ul style="list-style-type: none"> + Extremely drought-resistant and long-lasting. + Regrows very early and strongly in spring. - As green fodder, it is not appreciated by livestock as it has a bitter taste due to saponins. - It is not resistant to frequent cutting and increased grazing. 	Productive mown grass for hay production. Not suitable for grazing or early cutting.	Common grass of low-intensity, moderately fertilised hay meadows.
Tall fescue	<ul style="list-style-type: none"> + The new varieties have fine, supple leaves and are highly digestible. + Yields are guaranteed thanks to a deep root system. 	Ideal for intensive and long-lasting blends	Dry situations
Birdsfoot trefoil	<ul style="list-style-type: none"> + A valuable and undemanding fodder legume. + Adapted to drought. 	Used in mixtures to create species-rich meadows.	Very persistent in low-intensity natural meadows, pastures and alpine pastures.
White clover (drought tolerant)	<ul style="list-style-type: none"> + The small-leaved form, with its lower yield, is more tolerant of drought than the large-leaved form. + High fodder value + Stolonerous and perennial + Less sensitive to drought and cold and less demanding than red clover in terms of soil quality. 	Withstands frequent use very well. Also suitable for intensive grazing (resists trampling and frequent browsing).	Common from plains to mountains.