LEGUMES IN GRASSLAND – INTELLIGENT COMBINATIONS HELP SAVE COSTS

Is it possible to produce high-quality forage despite high input prices? Introducing legumes into grassland can do the trick. Hubert Kivelitz from the German Chamber of Agriculture North Rhine-Westphalia discusses the basics and the most effective ways of overseeding.

Legumes have the ability to enrich the soil with nitrogen at nearly no extra cost – by entering into a symbiosis with nodule bacteria which fix nitrogen from the air. For example, white clover – the most prominent forage legume in permanent grassland stands – can create 3-5kg of nitrogen per hectare and yield share. More and more farmers are trying to harness this ability as a strategy to counter the enormous price increase for N fertiliser. Another reason for considering legumes is that a reasonable share of high-protein legumes in grassland improves the quality of the forage feed and also the feed intakes. In addition to that, aging more slowly than grasses, legumes increase considerably the use flexibility of a stand. Yet, is it easy to integrate forage legumes in non-legume grassland swards?

And what is the best time for seeding?

Trials at the LAZBW Agricultural Centre in southern Germany, for example, show that the following timings suggest the greatest success:

After the first cut: Warm summer temperatures promote early growth and the formation of nodule bacteria. Drawback of this strategy is that it involves some intensive harrowing which impacts the yield levels of the second cut and increases the risk of yield loss in hot and dry summers.

- Red clover is sown at rates of 5-8kg/ha

After the third or fourth cut (in late summer): The advantage of this strategy is that it reduces the competition in the existing sward. This said, the oversown legumes, will also grow more slowly than in May/June.

- Red clover is sown at rates of 8-12kg/ha.

White clover should be sown at a rate of 3-6kg/ha no matter the timing. Overseeding white clover into permanent grassland is useful only in stands that grow only little or no white clover as yet.

Create gaps, then oversow

Legumes show slow initial growth. To establish them in the existing sward, it is necessary to keep potential competitors out. Therefore it is recommended to do one or even three brisk harrowing passes in dry soils. If this produces large amounts of dead plant matter, it should be raked and removed from the field. A trailing roller will improve the seed-to-soil contact. You can combine clover overseeds with small volumes of perennial ryegrass (5-6kg/ha), depending on the number of gaps in the sward. After suc-

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Nodule bacteria: Legumes like white clover enter into a symbiosis with nodule bacteria which form along the root. These bacteria fix atmospheric nitrogen, thereby contributing to the overall N supply of the main crop via the legume. White clover can provide 3-5kg/ha of N per yield share.

cessful establishment, red clover can in the first year after sowing already contribute a significant share to overall yields. White clover requires good start-up and growth conditions and takes at least two years before it establishes in grassland.

» AFTER ALL, ONLY A SUSTAINED REDUCTION OF N CREATES GOOD CONDITIONS FOR MAXIMUM LEGUME YIELDS.«

Hubert Kivelitz

Reducing N fertiliser

An essential incentive for growing forage legumes is the reduction of N inputs. In situations where N rates (chemical or organic) exceed 80-100kg/ha, the legumes will eventually be crowded out by the grasses. This applies more to white clover than to red clover. Although higher N rates may not harm the legumes themselves, they will primarily encourage the growth of grasses and non-legume species. In addition to that, high N rates reduce nodule bacteria activity. Therefore intensive livestock farming with high nitrogen outputs and slurry rates will make it difficult to establish legumes in grassland. After all, only a sustained reduction of N creates good conditions for maximum legume yields. When clover accounts for a share of 20-30% and more in the stand and N rates are reduced accordingly, yields are unlikely to drop – especially in grassland and forage stands that contain red clover. This contrasts with 100% grass stands that received moderate N treatments (150-200kg/ha total N). For this strategy to work, it is necessary that all other conditions are met for encouraging the development of legumes.

Phosphorus, optimal pH value

For encouraging rooting and a balanced presence of energy, it is necessary to ensure a sufficient supply of class ‘C’ phosphorus. If legumes lack phosphorus, they’ll show a slow growth, less resilience and reduced germination capacity. At the same time, phosphorus has a significant impact on the fixation of nitrogen by nodule bacteria.

A pH between 5.5 and 6.5 provides excellent conditions for an optimum balance of the main nutrients phosphorus, potash, magnesium and sulphur.

Red or white clover is also a question of variety

Red clover

- Rapid initial growth makes this clover a strong competitor which establishes faster and more effectively in grassland than white clover.
- It produces higher yields and tolerates extended periods of drought. As such, it is able to establish in crops with a large share of upper grasses.
- However, regenerating from its root, red clover is less persistent when cut frequently or especially when pastured. By comparison, the so-called "mat (red) clover", is considered somewhat more persistent.
- The benefits begin to dwindle after 3 years, possibly very abruptly and without any obvious signs of warning. Therefore, timely overseeding with grass is necessary.
- The various Chambers of Agriculture provide recommendations on the most suitable varieties for local conditions and these recommendations should be followed by all means. Persistence and resistance to diseases are the major criteria for selecting a specific variety.

A variety that matches the regional conditions will be less prone to disease or risks of overwintering.

White clover:

- White clover is encouraged by frequent cuts and especially intensive grazing.

TABLE 1: SUMMARY: WHICH CLOVER FOR WHICH SITUATION?

Red clover	White clover
Rapid establishment	Permanent establishment
High yields in a short period of time preferably grown in non-grazing schemes	Frequent cuts and/or intensive grazing
In extended drought periods	
In stands with a large percentage of upper grass or perennial ryegrass	In stands with a large percentage of lower grass

Before you can overseed clover or clover/grass mixes, it is necessary to create gaps. In this case, the land was harrowed three times. Seeding should then be done by a reseeder that cuts slots into the ground for good seed-soil contact.

- Forming shoots that creep on the ground and seeding continuously, white clover establishes permanently in grassland stands that offer appropriate conditions.
- The share of red and white clover in grassland will increase from the second growth.
- Develops well when combined with lower grasses (perennial ryegrass and smooth stalked meadow grass).
- Develops poorly in upper grasses (cocksfoot, timothy, meadow fescue, tall fescue) that are cut up to four times per year. Even with reduced N rates, only low yield shares are then developed.

Experience shows that especially white clover doesn't guarantee a persistently high and uniform share in overall yields even though it is encouraged by the proper crop management.

Establishing white clover by overseeding is a difficult undertaking, because the crop shows a slow initial development. Grazing is a good strategy after establishment, because this will encourage the spread of the species.

Red clover has a well-developed taproot. The nutrients are stored here so regeneration after cutting starts here.

Overseeding a mix of red and white clover?

A mix of red and white clover is basically another an option for overseeding. The aim here is that white clover, which shows a slower growth, progressively replaces the receding red clover and eventually takes its place. For this it is necessary to observe the needs of white clover. The real-life experience of this strategy is however that during the first three years white clover is suppressed too much by red clover – to the effect that it has disappeared or is significantly decimated by the time red clover recedes. In cold and wet regions, swede clover is more suitable than red clover although it produces much lower yields.

Annual savings: €90-190 per ha

Depending on the cropping system or machine and management costs, the costs for sowing red clover, for example, range between €130/ha and €280/ha including the expenses for the seeds (see table 2). The management cost during three years range between €43/ha and €93/ha per year. Assuming that this method can save 80-100kg/ha N per year and further assuming N prices of €2.30/kg (assuming the same yield performance depending on the method), this results in calculated savings of around €90 to €190 per ha and year. The savings on the purchase of fertiliser correspond to a forage quantity of 4.5 to 9.5dt*/ha, assuming production costs of €20/dt DM grass silage.

Summary

Especially forage producers with rather extensive usage and fertilising schemes in place (hilly sites and transitional areas; small herds) will benefit from a clover strategy in permanent grassland.The advantages are:

- Increased nitrogen supplies (e.g. 3 to 5kg/ha N by white clover)
- Higher feed intakes, better feed quality
- Optimised use flexibilities of the stands

This said, the following facts should be borne mind:

- Establishing red clover, white clover, alsike clover or lucerne in grassland swards is not too easy.
- The site must provide a suitable nutrient supply and pH value – ideally a pH of 5.5 and 6.5.
- Before adopting a legume overseeding strategy, carry out trials on smaller fields or plots.
- Wet and boggy sites are less suitable for growing legumes.
- An adapted N application ensures optimal development of nodule bacteria.

*=1dt is the equivalent to 100kg

Hubert Kivelitz
Chamber of Agriculture
North Rhine-Westphalia
Phone +49 221 5340 532

TABLE 2: COSTS FOR OVERSEEDING FORAGE LEGUMES INTO PERMANENT PASTURE/GRASSLAND

Treatment / Machine	Costs (€/ha) incl. tractor, operator, fuel*	Number of treatments	Total costs (€/ha)
6m grassland harrow	36.00	1–2	36.00-72.00
8–12m rotary rake	20.00	0–1	0.00-20.00
3m grass reseeder, (600 l)	69.50	1	69.50
Forage wagon (average cost)	54.00	0–1	0.00-54.00
Total incl. seeds			130–280

* Increased diesel costs of 1 euro compared to 2020 were taken into account