



C2 Development of a biodiversity friendly undervine management

C2's Project Deliverable Product:

Undervine management guideline for practitioners

Der Inhalt auf den folgenden Seiten ist die Broschüre „Gassner-Speckmoser K., Graiss W., Menhart K., Dreisiebner-Lanz S., Hauschild A., Redl C. and Krautzer B. (2025): Practical guide for undervine vegetation management – Taking biodiversity and erosion control into account.“ Part of Project LIFE VineAdapt. 16 p.

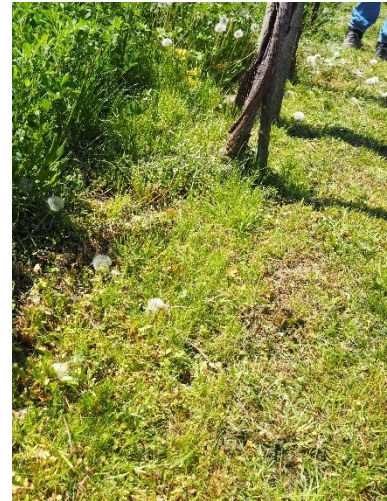
Summary:

Herbicide-free undervine management is gaining importance in viticulture. Current methods, mostly mechanical, show mixed results and lack sufficient data. While synthetic herbicides like glyphosate are effective, they harm biodiversity and the environment and may soon be banned.

Within LIFE VineAdapt's Action C2 biodiversity-friendly alternatives were tested: Mechanical methods, organic acids and greening of undervine area. The aim is to assess weed control, biodiversity impact, and erosion prevention. The guideline presents an overview about the methods and available seed mixtures for expansion of regional low growing permanent greening in the undervine area.

Practical guide for undervine vegetation management

Taking biodiversity and erosion control into account



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1. Introduction

The testing and demonstration of different approaches to biodiversity-friendly understock treatment in vineyards was carried out as part of Life VineAdapt on trial plots in Southern Styria, Lower Austria and in the Saale-Unstrut region in Germany.

Herbicide-free management of the understock area with little effort, which does not compete with water and nutrients for the vines, should be tested. One approach was the sowing of low-growing, perennial and site-adapted species with little biomass production, which can subsequently be maintained with customary brushing equipment. On the other hand, an approved product containing an organic acid (pelargonic acid) and acetic acid was tested for experimental purposes for their effect and practicability in understock treatment.

2. Methods for undervine treatment

Mechanical weed control is carried out by intermittently working the undervine area in order to minimise competition and reduce desirable species. It is used for weed control, disruption of soil-borne diseases and pests, reduction of surface acidification, acceleration of soil warming, reduction of nitrogen immobilization, reduction of heavy metal accumulation in topsoil, incorporation of fertilizers and removal of compaction (Blanco-Canqui and Wortmann 2020). If you look at the last point of this list, you quickly notice what a strongly negative cycle can result in highly intensified soil cultivation. Tillage by heavy machinery leads to compaction, erosion and a decrease in humus content (Kadisch and Müller 2019).

Disadvantages of mechanical soil cultivation according to Rühmer (2019):

- Channel formation
- If soil cultivation is too intensive, it can lead to increased degradation of humus
- Risk of erosion on slopes during heavy precipitation
- Vine damage caused by the use of equipment and machines
- Soil structure is lost



Figure 1: Erosion in non greened undervine area, Lower Austria

2.1 Flat coulter

The flat coulter is also called understock scraper. In this mechanical cultivation method, the flat coulter is pulled a few centimetres below the ground, the soil is lifted and the turf is broken. Growth is interrupted and in ideal weather with high temperatures, the vegetation dies. In addition, rotary tillers are sometimes attached to finely crush the lifted earth (Schulz 2018).



Figure 2: Flat coulter (agriculture.public.lu)

2.2 Rotary hoe

The rotary hoe usually has two star-shaped discs arranged next to each other, which tear up and loosen the overgrown soil. The aggressiveness of the cultivation can be controlled by the angle to the vine. When working, the height of the grasses and herbs should not be too high, otherwise blockages can occur between the panes. A trailing finger hoe with star-shaped finger nubs presses the horizontally loosened earth on the ground again (Walg 2020).



Figure 3: Rotary hoe und finger hoe (Luttenberger und Steiner 2022)



Figure 4: Cultivated undervine area (Kloster Pforta, Deutschland)

2.3 Plough disc

The soil is ploughed up at a depth of approx. 5 - 15 cm and thus the roots of the vegetation are separated from the ground and the vegetation is partially covered with soil. In the understock area of the vines, you then have predominantly open soil. The grasses and weeds can no longer grow and you reach a vegetation-free understock area (Schulz 2018).



Figure 1: Plough disc (Luttenberger und Steiner 2022)

2.4 Untervine mulcher

The undervine mulcher mows the grass between the vines. A big advantage of this machine is that you can use it with a mulcher, but also with a trunk cleaner. Little or no damage is caused to the vine trunk (Luttenberger und Steiner, 2022).



Figure 2: Untervine mulcher (Bernhardsgrütter Landtechnik AG)

2.5 Brushing device mounted on mulcher

The brushing device is an attachment to remove vegetation in the undervine area. The brush is powered by a hydraulic oil motor and rubber strips are attached to the shaft that knock off the plants. The method with a brush is widely used throughout Styria to avoid the need of herbicides (Luttenberger und Steiner, 2022).



Figure 3: Brushing device mounted on Mulcher (FS Silberberg)

2.6 Manual mowing with string mower

This form of maintenance is only practicable on small areas or terraces, requires a lot of labour and is physically demanding.



Figure 8: String mower

2.7 Organic acids as contact herbicides

Testing of the approved contact herbicide pelargonic acid

Important note: The current authorisation of the respective herbicides and their areas of application and timing can be found in the current plant protection product register of the respective country.

Acetic acid was also used for experimental purposes, which had a comparable effect to pelargonic acid. Both acid treatments had only a minor and not long-lasting effect, only surface damage to the treated undervine vegetation occurred. The effect of the acids was insufficient and a necessary repeated application during the vegetation period is not permitted. Plants can regenerate and sprout again.



Figure 9: Damage caused by contact herbicide

3. Greening of the undervine area

Instead of the usual procedures for keeping the undervine area free of vegetation, undervine greening is intended to contribute to a more sustainable management of this area in vineyards.

Undervine greening also has the advantage of permanent soil cover, which reduces the risk of soil erosion, silting and compaction, especially during heavy rainfall on steep slopes and terraces. If successfully established, undervine greening with low-growing plants should significantly reduce the amount of work in the undervine area over several years, as in terraces, for example, it is only possible to mow the undervine by hand. The aim is also to develop recommendations for action for the practice of sowing certain plant species in the understock area depending on the location. Existing low-growing vegetation is also to be promoted without a ground opening, into which it is mowed high and can spread naturally.

The aim is to establish a permanent, site-adapted greening that offers the suppression of unwanted weeds and has a persistence against mechanical processing (mowing, brushing). The risk of erosion is reduced by the year-round covering of the soil, especially on steep slopes.

3.1 Area selection and timing for undervine greening

Strong weedy plants are not suitable for seeding undervine greening, because particularly runner-sprouting weeds, such as couch grass or neophytic plants such as e.g. *Amaranthus retroflexus* are a problematic competitor during the slow juvenile development of some sown species. Both **spring sowing and late summer sowing** in a mild viticultural climate are possible. Sowing in young plantations is not recommended due to possible competition with the vines.



Figure 10: Heavy growth with *Polygonum aviculare*



Figure 11: Heavy growth with *Amaranthus retroflexus*

3.2 Selection of seed mixture: grasses or grasses-herb-clover

Greening in the undervine area can either be sown at great expense, planted or created by natural growth. Grass mixtures are best suited to suppress unwanted weeds but must be selected adapted to the climatic conditions of the site due to their strong water competition (Hörmayer 2022). Pure clover mixtures in the basement often have a patchy stand and can very quickly be displaced by spontaneous greening (Dreisiebner-Lanz 2020). Compared to spontaneous or natural undervine greening, mulching can be reduced by sown, low-growing species (Hofmann 2014).

Two pure grass mixtures and a species-rich mixture with four herbs and three fescue species are available for ordering to offer seed mixtures for different winery concepts.

3.3 Seed mixtures for permanent greening in the undervine area

A research cooperation between the Life VineAdapt project and the Vinea Wachau winegrowers' association led to an assessment of the suitability of various regionally available plant species for understory greening from 2022 to 2024. Ongoing surveys (monthly during the growing season) were carried out to document how the sown greening variants were developing. For this purpose, a 60 x 60 cm wooden frame was placed in the understory area for each credit rating and an estimation of the projective cover was carried out.

The fescue species (red, sheep, furrow fescue), horned clover and thyme were particularly noteworthy which were able to convince with growth and establishment. Above all, the common thyme (max. 10 cm), but also the fescue species stood out with their low growth, even in periods with higher rainfalls. The fescue species grew up to 30 cm high, but then folded over and thus a growth height of about 15 cm was reached.

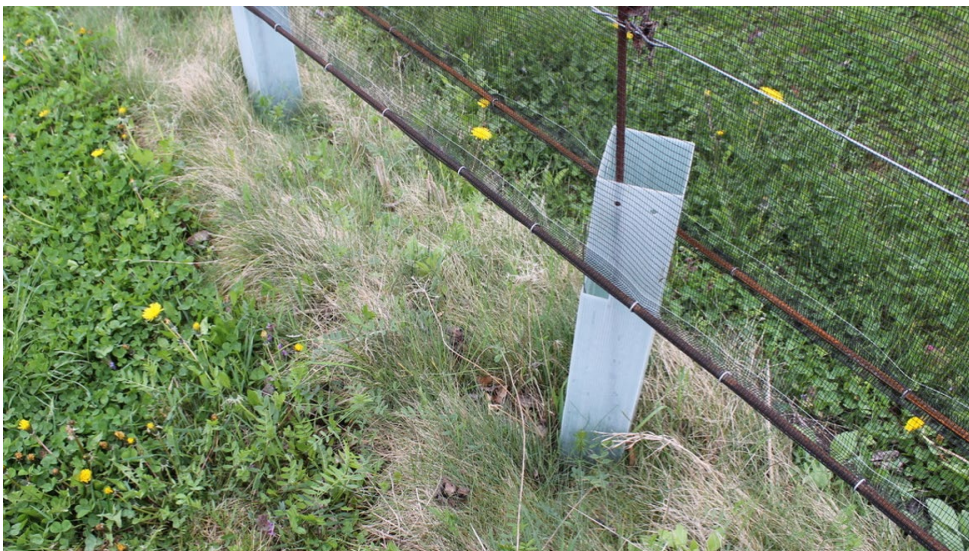


Figure 12: Dense, low growing greening variant

3.4 Surface preparation in the undervine area: mechanical or manual

The undervine areas are either mechanically cleaned with a roller hoe, an underfloor scrape, a plough disc or prepared with similar tillage equipment.



Figure 13: Battery-powered motor hoe



Figure 14: Prepared seedbed

In vineyards that are not tractor-drivable, the area is opened by hand or with a hoe to remove the existing vegetation. The seedbed should be weed-free, without rhizomes and well settled.

3.5 Sowing: manual and shallow

Sowing in densely overgrown, weedy areas is not recommended. Dry sand is recommended as a filler to achieve a sufficient sowing volume at the seed strengths of 4-5 g/m² for hand sowing. For recompacting the soil is rolled with a hand roller to ensure that the shallowly sown seeds have direct contact to the soil.

The UBIWEIN project is working on the development of machines for sowing in the undervine area.



Figure 15: Hand roller for re-compaction

3.6 Seed mixtures for permanent greening in undervine areas

W5 Gumpensteiner Unterstockmischung

100 % grasses:

Festuca ovina, Festuca rupicola

W4 Gumpensteiner Kurzrasenmischung für Obst- und Weinbau

100 % grasses:

Festuca ovina, Festuca rubra commutata, Festuca rupicola

Gumpensteiner Artenreiche Mischung für Unterstock-Begrünung

90 % grasses:

Festuca ovina, Festuca rupicola

10 % herbs:

Lotus corniculatus, Silene vulgaris, Achillea millefolium, Thymus pulegioides

Sources for regional seeds

Germany

Rieger-Hofmann GmbH

<https://www.rieger-hofmann.de>

+49 7952 921889-0

info@rieger-hofmann.de

Saalesaaten: DI Matthias Stolle

<https://www.saale-saaten.de/>

+49 345 522 9303

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Kärntner Saatbau e.Gen

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+43 463 512 208

office@saatbau.at

4. Maintenance of permanent undervine greening

High mowing or brushing are recommended. Correct mowing height and management are very important and decisive for the promotion of sown greening. If mowed too low, they are damaged, and their development is disturbed. If weed pressure is high, more frequent mowing is necessary, especially in the first two years, in order to keep competition for the young plants low. In the case of well-developed, grass-rich greening, the low-growing cushions can also completely eliminate mowing cycles because the tufts can then fall over and form a dense carpet.



Figure 164: Well-developed species-rich greening



Figure 17: Well-developed grass-rich greening

5. Conclusion on alternative undervine management

Mechanical processing with the Held brush or the rotary hoe is the most effective method. Mechanical processing with the rotary hoe enables an effective combination of work steps, so that multiple processing per year is possible. Soil opening is hardly ever carried out on steep slopes at risk of erosion, such as in southern Styria, but more frequently in arid areas such as the Saale-Unstrut region, Lower Austria and Burgenland. This is particularly necessary in the event of high precipitation and thus stronger growth in the US area. This method is ideal for the simultaneous application of plant protection products and fungicides. In the Saale-Unstrut region, a new understock thread mower, the "BÄHR Power Clean Brush", will also be used for the first time. This technique makes it possible not to open the soil, which reduces erosion while ensuring coverage with mulch material.

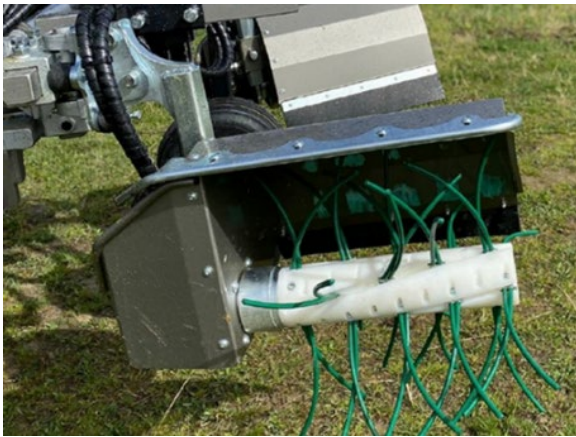


Figure 18: BÄHR Power Clean brush (BÄHR Weinbautechnik GmbH)

The sowing of suitable, low-growing species is promising, but long-term surveys are necessary in order to be able to assess possible competition with the vine.

Mulching material in the spraying process could be an alternative in the future, but no practical device is yet available for application.

In Austria, three seed mixtures are available for understory greening and can be ordered via www.saatbau.at/webshop/.

The HBLA Klosterneuburg is continuing a 5-year research project ("UBIWEIN – Unterstockbegrünungen im Weinbau") to investigate the long-term effects of undervine greening on vine growth, yield and wine quality.

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