Insect Responsible Sourcing Regions

Boosting biodiversity

Measures for more insect diversity in agriculture, municipalities and gardens

Life

Bodensee Stiftung
Lake Constance Foundation

Global Nature Fund

netzwerk blühende landschaft

BÄUERLICHE ERZEUGERGEMEINSCHAFT SCHWÄBISCH HALL

Nestlé
Good Food, Good Life

Imprint

Project partners

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Note

You can also find this catalog in **German, Spanish** and **French** at:

insect-responsible.org/massnahmen__instrumente

Contents

Introduction

Industrial agriculture has significantly contributed to the decline in biodiversity, especially insect populations, over the past few decades.

This necessitates the need to counteract insect loss through integrative agricultural measures and the creation of structures. Farmers, companies, municipalities, and citizens must recognize their own potential to promote biodiversity and consistently implement the necessary measures.

The EU LIFE project Insect-Responsible Sourcing Regions (IRSR) primarily aimed to develop feasible and economic solutions for biodiversity- and insect-friendly agriculture at a regional level, with the active involvement of as many land users as possible. The goal of IRSR is not only to disseminate common and proven measures to support pollinating insects in agriculture but also to test and strengthen the ecological effectiveness and practicability of more advanced farming practices. IT tools have been developed to assess the potential for action in agricultural enterprises and to evaluate the results of applied measures. These tools have helped farmers identify their specific opportunities to promote biodiversity and provided information on areas for improvement.

As an EU LIFE project, the IRSR concept and its results are internationally transferable. The catalogue of measures developed within the project for promoting insect diversity has been translated into four languages to make them applicable across Europe in the long term.

Measures to promote biodiversity are not complicated to implement; in some cases, they even reduce the workload or ensure the yield of agricultural crops. A richer and more diverse food supply and habitat automatically attract a variety of insects when implemented correctly. Farmers can actively contribute to preserving cultural landscapes and promoting ecosystem services as well as local flora and fauna through concrete measures. Other land users can also support this sustainable development through small behavioral changes.

This catalog provides a comprehensive compilation of practical information on measures to promote biodiversity, especially for agricultural enterprises but also for municipalities and other stakeholders. The measures are tailored to the Central European region but can be adapted for implementation in other regions. Many of the measures can be financed through EU programs as well as national or regional programs. By combining various measures, a coherent network of structures for promoting biodiversity can be created.

Biodiversity-promoting measures in arable farming

Field margins

Description of the measure

Field margins serve to promote species-rich arable flora and increase the supply of flowers for insects. Field margins are cultivated with the same crop at the same sowing density as the rest of the field, predominantly in cereal crops, not maize. Ideally, the field margins should be planted on lean land with little or no weeds such as dock, couch grass or thistles. Shady and nutrient-rich sites are unsuitable.

Implementation and maintenance

- Minimum width 3-12 m, minimum area 0.3 ha
- No use of pesticides
- Mechanical weed control possible, but should be reduced to a minimum
- No fertilization and liming
- Plowing late in the year, ideally overwintering

Effects on biodiversity

Field margins can be important elements of biotope connectivity. Thanks to lower inputs of substances and the usual edge effects, typical arable flora can find an extended habitat here. Many wild field herbs provide valuable food for insects. Field margins also provide a habitat for birds and small game.

Further positive effects

Field margins have an ecological buffer function against material inputs and outputs.

Further recommendations

In cases of heavy infestation with problem weeds, plant protection products can be applied selectively. Yield-reducing weeds can be targeted early on if necessary. Stubble cultivation should only be carried out late or in the following spring.

Field margins should be maintained for as long as possible, at least two years on the same area.

For further reading: *Becker, N., Muchow, T. & Schmelzer, M. (2019). AgrarNatur-Ratgeber - Arten erkennen - Maßnahmen umsetzen - Vielfalt bewahren (ed. Stiftung Rheinische Kulturlandschaft), Bonn, 220 pp*

Sources: *www.kulturlandschaft.nrw/project/ackerrandstreifen* • *www.landwirtschaftskammer.de/landwirtschaft/naturschutz/biodiversitaet/extensivacker/index.htm*
www.rheinische-kulturlandschaft.de/massnahmen/a3a-ackerrandstreifen

Agroforst – Alley Cropping for stem wood production

Description of the measure

Alley cropping describes a system in which rows of trees or bushes and conventional arable crops are grown alternately. The cultivation of noble hardwoods is ideal for stem wood production. Suitable tree species include walnut, black walnut, service tree, wild pear, but also maple and linden. The aim is to produce high-quality trunks of sufficient size and the highest possible quality.

Choice of tree species

It is essential to match the site characteristics with the site requirements of the tree species. No tree species should be selected that cannot tolerate the climatic conditions in open spaces (strong sunlight, heat, late frosts). If possible, only regional and certified origins should be used. Exotic tree species should be avoided as far as possible due to a lack of knowledge about their distribution, growth and ecological impact.

Implementation

The design of the rows of trees leaves plenty of scope. Please note:

- Machine-compatible distances between the tree strips (everything is possible, from canopy closure over the field strip to max. 100 m distance)
- If the soil is heavily compacted, deep trenching may be necessary
- Planting of bare-root or balled and burlaped young plants with the best possible characteristics (straight-shafted, no deformation of the stem axis, fine branching, regularly formed crown)
- Distance within the row: 8-10 m
- Installation of tree shelter against game browsing
- Setting up perches for birds of prey to control the mouse population
- Provide tree strips with brushwood piles and integrate weasel boxes (see „For further reading“)

Maintenance

- Regular (at least annual) inspection of the quality and vitality of the trees
- Replanting failed trees
- Annual pruning of the tree crown: remove the lowest branches and steep branches (1-2 per year, never more than a third of the green crown); break up tree forks; if necessary, remove water sprouts; if possible, do not remove branches with a diameter > 4 cm.
- No further pruning measures from 4 m knot-free trunk area (the longer the knot-free trunk, the higher the timber value)
- Harvestable at a diameter of at least 60 cm (the thicker, the higher the timber value)

Effects on biodiversity

Agroforestry systems bring about a significant and lasting increase in structural and habitat diversity. With the right choice of tree species (especially roses), they provide flowers, nectar and pollen for wild bees, bumblebees and other insects. They also serve as a refuge for various animal species during agricultural work and as a habitat for field birds and small mammals.

Further positive effects

Leaf fall and root growth on the wooded strips lead to a substantial accumulation of humus and thus to an improvement in the soil. At the same time, agroforestry systems protect agricultural land from drought and wind erosion. They thus mitigate the consequences of climate change and relieve the burden on irrigation systems in the future.

Finally, with the right choice of tree species, fruit and nuts and the resulting foods can have a positive impact on the overall economic result even before the logs are harvested.

Further recommendations

Injuries to the logs should be avoided at all costs. Any resulting discoloration will devalue the logs.

Shallow roots should be regularly directed downwards by appropriate soil cultivation (shearing) so that they do not extend into the field strips. There is not sufficient experience regarding the growth and quality development in the open for some noble deciduous trees. Accordingly, there is a lack of maintenance concepts from forestry/silvicultural practice that can be transferred to the agricultural context.

For further reading: www.defaf.de • https://www.bund-lemgo.de/Mauswiesel_und_Hermelin.html

Sources: *Hübner, R.; Guenzel, J. Agroforstwirtschaft: Die Kunst, Bäume und Landwirtschaft zu Verbinden; Deutscher Fachverband für Agroforstwirtschaft (DeFAF) e.V. Cottbus: Cottbus, Germany, 2020.*

Flowering catch crops

Description of the measure

Catch crops are grown between two main crops as green manure or for fodder use. Alternatively, an undersown crop (see measure sheet „Wide row with flowering undersown crop“) is sown with a main crop and can be used after harvest but also fulfils the ecological and agronomic functions of a catch crop.

Implementation

- Sow as soon as possible after clearing the previous crop
- Adaptation of the components to crop rotation / consideration of compatibility with the main crop (e.g. with regard to viruses, sclerotinia, nematodes, cabbage hernia) and the site factors (light/heavy soils, climate, precipitation, slopes)
- Possible risk of poor establishment with late-sown species/ mixtures
- Adaptation of the sowing technique to the mixtures (light requirement, size, shape, TKW)

Effects on biodiversity

Catch crops provide habitat and food for insects, among other things by acting as a (relatively late) source of pollen or nectar and by reducing the nutrient concentration in the soil. Overwintering catch crops offer insects and small wildlife opportunities for overwintering and protection, as well as seed stands for birds. The rooting of the catch crops and the subsequent decomposition of biomass increases soil biological activity.

Further positive effects

Catch crops reduce nutrient leaching and water erosion through root penetration and soil cover. They improve water retention capacity and soil structure. Leguminous plants can also introduce additional nitrogen into the soil. In this way, catch crops increase general soil fertility.

Further recommendations

The formation of mats can influence drying and nutrient turnover in the following year. In addition, seeds that shed can influence the subsequent crop. Precipitation should be considered a key factor in planning for successful catch crop growth.

For further reading: *https://ltz.landwirtschaft-bw.de/,Lde/Startseite/Kulturpflanzen/Zwischenfruechte+und+Untersaaten*

Flowering headland

Description of the measure

Flowering seed mixtures can be cultivated in arable areas that are heavily stressed by the turning of agricultural machinery and consequently have poorer yields.

Sowing

- Annual flowering mixtures with regional seeds or legume mixtures of at least 4 species
- Preparation of a fine-grained but firm seedbed
- Sowing with a combined/simple seed drill or fertilizer spreader
- Must not be sown too densely for light-demanding species
- Rolling the seeds improves soil contact and germination
- Sowing in spring (end of April - mid-May) across the entire width of the headland (approx. 6 - 15 m)
- No use of fertilizers and pesticides
- Sowing directly after cultivation or after weed control to avoid trampling in root crop fields

Maintenance

- Headlands can be driven on during normal cultivation of the areas
- Only mow the area if weeds are too high or in the case of legume mixtures (then only after flowering)
- Minimum interval between maintenance work on ditches and bodies of waters of 8 weeks
- Ideally, the flowering mixture should be maintained beyond the cultivation period until winter or even sown with perennial flowering mixtures (see measure sheet „Flowering insectary strips „)

Effects on biodiversity

Flowering mixtures provide flowers, nectar and pollen for wild bees, bumblebees and other insects. The flowering headland serves as a refuge for wild animals and insects during agricultural work and field birds and amphibians can also use it as a feeding area and benefit from the absence of pesticides.

Further recommendations

Areas with rare arable weeds or with a potential risk of problematic weeds are not suitable for growing seed mixtures.

Further positive effects

Flowering headlands contribute to biotope connectivity if they are designed in such a way that they link forest edges, field edge structures and meadows. Furthermore, soil structure and humus accumulation in the headland are favoured. In species-rich mixtures, different root formation, depth and exudation contribute to the promotion of soil life. In addition, the water storage capacity of the soil in the headland is improved and the field is visually enhanced.

For further reading: www.franz-projekt.de/uploads/Downloads/Massnahmen/Ma%C3%9Fnahmenblatt_Bl%C3%BChendes%20Vorgewende_mit%20Bild.pdf

Sources: naturschutzbund.at/files/NATUR%20VERBINDET/Bluehstreifen1.pdf • bluehende-landschaft.de/handlungsempfehlung/insektenfreundliche-bluehstreifen • www.kiepenkerl.de/rundum-wildacker/bluehstreifen

Fallow land

Description of the measure

Fallow land is land that is temporarily left without cultivation. It differs in the duration and vegetation of the fallow land, so it can be either rotational fallow land (annual) or perennial fallow land, which is either sown or left to self-vegetate. Fallow land provides space for site-adapted plant and animal species (e.g. wild herbs, beneficial insects, field birds and mammals).

Implementation

- Self-vegetating fallow land is particularly preferable in poor locations (development of rare wild herbs and high species diversity)
- Sowing of site-typical, diverse seed mixtures on high-quality growth sites
- Rotational fallow: at least one year until the end of winter
- Perennial fallow land: desirable, as species and structural diversity increase with age
- Biodiversity increases with the size of the fallow land
- Self-planting directly on stubble fields, if possible after seedbed preparation

Maintenance

- Mowing or mulching max. once a year (in the case of perennial fallow land not from April to June), adaptation of cultivation to target species if possible (please observe the requirements if you are receiving funding!)
- Possibly cupping incision
- If possible, no cultivation from late summer to the end of winter

Effects on biodiversity

Species-rich, site-adapted vegetation provides food, hibernation and reproduction opportunities and protection for (endangered) insects, birds and even mammals such as hares and hamsters. Well-distributed fallow land serves to support the biotope network.

Further positive effects

The absence of fertilization and cultivation indirectly reduces fuel use and greenhouse gas emissions (N_2O, CO^2).

Further recommendations

The different approaches work best in combination. For example, it is advantageous to combine rotational fallow and perennial fallow, as they appeal to different insect and bird species and promote different plant species.

It is particularly advantageous if the fallow areas are established adjacent to extensively farmed areas, as the increased insect population on such adjacent areas favours the colonization of the fallow area.

Fallow land is a good solution for poorly located, difficult-to-cultivate or low-yielding sites. Sun-exposed areas should be preferred.

For further reading: https://www.nabu.de/natur-und-landschaft/landnutzung/landwirtschaft/artenvielfalt/vogelsterben/10366.html • 2022-07-DNR-Background-Basement-Unavoidable-Retreats.pdf

Sources: *Van Buskirk, Josh & Willi, Yvonne. (2004). Enhancement of Farmland Biodiversity within Set-Aside Land. Conservation Biology. 18. 987 - 994. 10.1111/j.1523-1739.2004.00359.x.*
Becker, N., Muchow, T. & Schmelzer, M. (2019). AgrarNatur-Ratgeber – Arten erkennen – Maßnahmen umsetzen – Vielfalt bewahren (Hrsg. Stiftung Rheinische Kulturlandschaft), Bonn, 220 S.

Extensive farming / light tillage

Description of the measure

Extensive farming is a nature-friendly form of agriculture in which less yield is generated on the same area of land. Many traditional forms of agriculture are extensive systems.

Location

- Preferably sites with low occurrence of competitive species or possibly already known occurrence of (endangered) arable weeds
- Lower-yielding sites, lean soils (e.g., limestone shear fields) or sites with pronounced relief (e.g., steep slopes and depressions)

Implementation

A combination of measures is necessary to maintain a species-rich area and especially to further develop the potential of rare arable weeds on the site:

- Double seed row spacing and reduced seed density (50-70% of conventional densities)
- Reduced and adjusted fertilization, maximum N surplus: 10 kg N/ha
- No application of synthetic chemical pesticides
- Harrowing and hoeing possible, but the field should not be absolutely clean
- Cereal-based multiple cropping (>60% cereals - 3 out of 5 years), including clover-grass
- Implementation possible in winter cereals and summer cereals
- Root crops and corn less suitable due to high nutrient requirements in the early stage but possible in cereal-based crop rotations
- Optimal duration of measures: at least 5 years
- Late stubble cultivation (for growth of very late flowering field wild herbs); stubble in winter serves as feeding and overwintering habitat for insects, birds, and small game

Effects on biodiversity

Due to the lower seeding density, especially light-demanding wild herbs are promoted. Insects benefit from flowering species in the area through increased nectar and pollen supply. Wild herbs also serve as food for small game and the stand provides protection from predators. Many field birds avoid tall and dense crops. Wild herbs and insects provide food and material for nesting.

Further positive effects

Reduced use of pesticides protects the fauna and promotes not only beneficial insects but also other animals (e.g. butterflies, grasshoppers, birds). In addition, crossings can be saved.

Cereal species and field weeds form a „plant society“ in which mutual interactions with positive effects occur, e.g., increase in water availability, soil improvement through nitrogen fixation, and improved soil structure.

There is evidence that the grain can achieve better nutrient uptake when wild herbs are present.

Further recommendations

Problematic weeds such as field thistle, field bindweed and dock can be controlled locally with a harrow. In exceptional cases, selective application of plant protection products with a backpack sprayer is possible to protect the crops. It is possible to change the areas if the weed pressure is too high.

Please note: The emergence of desired low-competition field weeds depends on the seed potential available in the soil. If this is present, a species-rich stand often emerges after a few years of extensification. If wild weeds fail to emerge even after adaptation of management, further reintroduction measures are possible.

Sources: *Becker, N., Muchow, T. & Schmelzer, M. (2019). AgrarNatur-Ratgeber – Arten erkennen – Maßnahmen umsetzen – Vielfalt bewahren (Hrsg. Stiftung Rheinische Kulturlandschaft), Bonn, 220 S.*

Crop diversification

Description of the measure

Crop diversification refers to the targeted cultivation of different types of crops.

Implementation

- In one year, at least 5 different main crops with a minimum of 10% to a maximum of 30% acreage each
- Legumes and mixtures with legumes on at least 10% of the agricultural area
- Maximum permissible proportion of cereals: 66%; winter and summer crops are considered different main crops, even if they belong to the same genus
- If more than 5 main crop types are cultivated, these can be combined if the minimum proportion of 10% is not reached for one or more main crop types

Effects on biodiversity

Crop rotation can reduce pesticide use, which benefits animals. In general, diversification promotes agrobiodiversity. The reduced use of nitrogen through the use of legumes has a positive effect on biodiversity.

Further recommendations

Fruit diversification is directly related to market opportunities.

Further positive effects

Cycle interruption limits the development of weeds, pests and pathogens. Legumes improve nitrogen supply. Cultivating crops with different root systems allows nutrient resources to be exploited from different soil depths and improves soil structure. At the same time, the agricultural landscape is diversified, thus favoring biodiversity - especially when plots are reduced in size, thus creating a habitat mosaic. Species diversification continuously provides different nutrient resources.

For further reading: *Case Study (engl.): "Crop diversification: obstacles and levers - Study of farms and supply chains"* *https://www.researchgate.net/publication/281438852_Crop_diversification_obstacles_and_levers_Study_of_farms_and_supply_chains*

Sources: *Ökoregelung 2 (Stand Nov. 2024): www.bmel.de/DE/themen/landwirtschaft/eu-agrarpolitik-und-foerderung/direktzahlung/oeko-regelungen.html*

Intercropping

Description of the measure

Intercropping refers to the cultivation of two or more species or varieties in mixture at the same time on one and the same field. Proven mixing partners are generally legumes with non-legumes:

- **Peas with barley/vineyard.**
- **Field beans with oats**
- **Vetches with rye**
- **Winter peas with triticale**
- **Phaseolus beans with corn**
- **Soybean with wheat**

More rarely, mixtures with cruciferous plants are also cultivated. Here, camelina should be highlighted as a positive example.

Implementation

Mixture of legumes and cereals:

- Proven mixing ratio: 80:40 (in % of the pure stand quantities of the two mixing partners).
- Advantage of fall seeding: legumes flower before summer drought, thus more pods.
- Regulation of fall weeds by spring seeding in rotations with a lot of winter cereals
- Sowing of mixtures with normal cereal seed drill (mix by hand in a separate container beforehand)
- Sowing of mixtures of cereal pure stands with normal row spacing
- Adjustment of sowing date to sowing date of grain legumes

Mixture of corn - pole bean:

- Mix ratio 80:40 to as high as 50:50, reduced seeding densities of 6-9 grains per sq. m. recommended.
- Stable varieties recommended for corn (e.g. KWS Figaro)
- Sowing of mixtures of pure stands with normal row spacing
- Sowing possible simultaneously (pneumatically or one row of corn and one row of beans 37.5 cm apart) or consecutively (bean at 4-leaf stage of corn)

Effects on biodiversity

Reduced nutrient and pesticide use has a positive impact on biodiversity in general, and flowering mixed components provide foraging habitat for insects.

Further positive effects

Intercropping results in better stability and harvesting of grain legumes. The (late) weeds are better suppressed. At the same time, yield stability is increased thanks, among other things, to better defense against/diversion of potential pests and the distribution of risk between two crops. In addition, nutrients, water and light can be used more efficiently. On average, 5-15 % higher total yields can be achieved over the years.

Further recommendations

The success of mixed crops requires, among other things, largely coinciding harvest times of the mixing partners, good stability of the mixture and good weed suppression. Because of the good weed suppression, the cultivation of mixed crops is particularly suitable for mulch sowing.

For mixed cropping with legumes, the soil should not be too shallow and/or too dry.

For further reading: *FiBL: Erfolgreicher Anbau von Körnerleguminosen in Mischkultur mit Getreide: https://www.fibl.org/de/shop/1670-koernerleguminosen-mischkulturen*

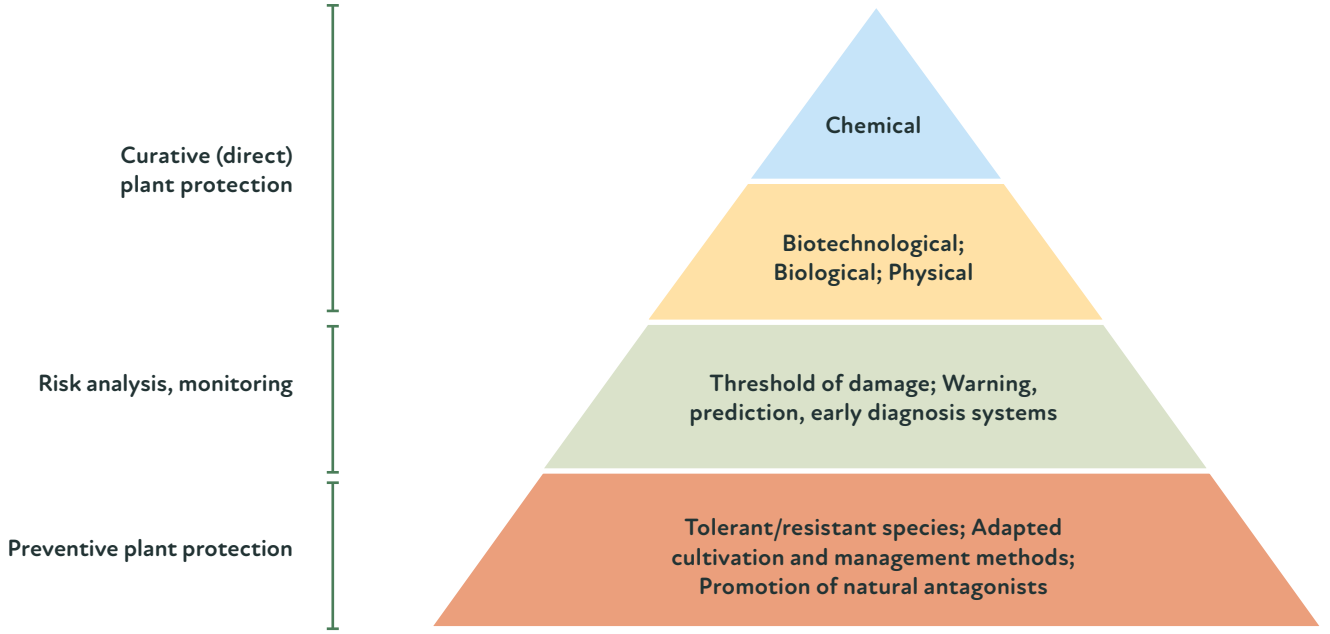
Sources: *Manuel pratique du BfN „Leguminosen nutzen - Naturverträgliche Anbaumethoden aus der Praxis“: https://www.fibl.org/fileadmin/documents/shop/1655-leguminosen.pdf*
https://www.oekolandbau.de/landwirtschaft/pflanze/gemengeanbau • https://franz-projekt.de/uploads/Downloads/Massnahmen/Ma%C3%9Fnahmenblatt_Mais-Stangenbohnengemenge_mit%20Bild%20(2).pdf

Integrated Pest Management (IPM)

Description of the measure

Integrated pest management“ (IPM) is a combination of methods in which biological, biotechnological, plant breeding, cultivation and cultural measures are given priority and the use of chemical pesticides is limited to what is necessary.

Essential instruments of IPS are:



(based on original by LTZ, 2021)

Effects on biodiversity

IPM also aims to achieve a high level of biodiversity in the agricultural landscape, especially among animals and field weeds. Reduced use of plant protection products protects flora and fauna and promotes other animals in addition to beneficial insects (e.g. butterflies, grasshoppers, amphibians, birds).

Further positive effects

The aim of IPM is to reconcile economic and ecological requirements. IPM can save operating resources and working time.

Sources: *Landwirtschaftliches Technologiezentrum Augustenberg (LTZ). (2021). Die allgemeinen Grundsätze des integrierten Pflanzenschutzes: Hilfe zur Umsetzung und Dokumentation (Stand: Februar 2021). Landwirtschaftliches Technologiezentrum Augustenberg: https://www.nap-pflanzenschutz.de/fileadmin/site_master/content/ips/integrierter_pflanzenschutz/grundsaetze-ips.pdf*

Flowering insectary strips

Description of the measure

Insectary strips are annual or perennial flowering strips for which the seed choice depends on the beneficial insects to be promoted.

Implementation

- One unit every 30 - 50 m to encourage immigration of beneficial insects into crop (can be attracted over approx. 60 m)
- Min. 2 m width
- Possible in cereals or vegetables

Location

- Fields without problematic weeds
- Not adjacent to permanent grassland because of too high slug pressure
- Biodiversity measure as previous crop unfavorable

Seeds should be adapted to the beneficial organisms to be promoted. Examples:

Beneficial insect	Beneficial plant species	Pest
Hoverflies	Umbelliferous plants such as wild carrot, composite plants such as cornflower, yarrow or marigold, buckwheat	Aphid, whitefly
Ichneumon wasps	Wild carrot, camomile, yarrow	Cabbage owl, cabbage white butterfly, cabbage moth
Ladybug	Compositae, White campion, Stinging nettle	Aphid, whitefly
Lacewing	Phacelia, borage, mustard	Various pests
Spiders	Mallow, viper's bugloss, comfrey, mullein	Various pests

Sowing

- Preparation of a fine-grained but firm seedbed
- Sowing with a combined/simple seeder or fertilizer spreader
- Must not be sown too densely for light-demanding species
- Rolling the seed improves soil contact and germination
- Sowing in spring (end of April - middle of May)

Maintenance

- If possible, avoid topping; If necessary due to very high weed pressure, implement as early as possible (mow to >10 cm)
- Ideally maintain the strip of beneficial weeds until the following spring

Effects on biodiversity

Beneficial strips provide flowers, nectar and pollen for wild bees, bumblebees and other insects. They serve as retreats and overwintering sites for insects, birds and small game.

Further positive effects

Natural pest control occurs due to the increase in beneficial insects. This can reduce the use of pesticides. For example, a 75 % reduction in aphids can be achieved compared to fields without beneficial strips, and a 60 % reduction in damage from cereal leave beetles. They also contribute to biotope connectivity when they link forest edges, field edge structures, and meadows. Furthermore, soil structure and humus build-up are favored. In species-rich mixtures, different root formation, depth as well as exudation contribute to a promotion of soil life. In addition, the water storage capacity of the soil and the field is visually enhanced.

Further recommendations

In principle, it should be noted that this measure should not be considered in isolation. Margin structures, hedges, fallows, and diverse crop rotations also contribute to the reduction of pests and provide valuable overwintering habitats for beneficial insects.

In years with a high incidence of pests, e.g. whiteflies, there is also a strong increase in beneficial insects such as hoverflies. Some of the hoverfly larvae and pupae can remain on the crop, which becomes a problem especially when the vegetables are packed.

For further reading: *Blühstreifen für Bestäuber und andere Nützlinge – Agridea: https://agridea.abacuscity.ch/abauserimage/Agridea_2_Free/2616_3_D.pdf*

Sources: *orgprints.org/id/eprint/30478/1/Luka-etal-2016-bluehstreiefn-AgrarforschungSchweiz-D.pdf • www.fibl.org/fileadmin/documents/shop/2500-schaedlingsregulierung-kohl.pdf*
Nützlingsblühstreifen für den Ackerbau reduzieren Schädlinge in Kulturen, Tschumi et al., 2016: https://www.agroscope.admin.ch/agroscope/de/home/themen/umwelt-ressourcen/biodiversitaet-landschaft/oekologischer-ausgleich/nuetzlingsbluehstreifen.html

Reduction of fertilizer use

Description of the measure

The aim is to fertilize crops in line with requirements and to improve nutrient efficiency. Nutrient surpluses and the associated discharges into ecosystems, water bodies and the air are to be reduced. Key tools for reduced and effective fertilizer use are:

- Annual preparation of a farm gate-related nutrient balance (farm gate balance)
- Annual preparation of a field- and crop-specific nutrient balance sheet to determine fertilizer requirements
- Alignment of the upper limit for nitrogen fertilization with requirement values by the regional official advisory service
- Regular determination of fertilizer requirements prior to the application of significant amounts of nutrients (N=50 kg/ha; P=30 kg/ha)
- Regular humus balancing (should never be negative and should be supplemented by a comprehensive humus survey every 6 years)
- Integration of catch crops for green manure, e.g. grasses, oilseeds or legumes, on farms with predominantly cereal crops

Effects on biodiversity

Lower and thus site-specific fertilization improves soil fertility, soil life and humus build-up. In addition, the pollution of groundwater and surface water is reduced, which has a positive effect on animal and plant life. Soil life benefits from an optimal supply of nutrients (including lime). With lower nutrient levels in the soil, even plant species with weak competition can develop and establish themselves.

Further positive effects

Precise fertilization in line with requirements saves operating resources and working time. At the same time, emissions of greenhouse gases (N_2O und CO_2) caused by excess N in the soil are reduced. In addition, it is imperative to save P fertilizers in view of the depleting natural P resources of the Earth.

Further recommendations

For optimal fertilizer management, advice from expert consultants can be helpful.

For further reading: *BLE Broschüre „Effizient düngen - Anwendungsbeispiele zur Düngeverordnung“: https://www.agrarheute.com/sites/agrarheute.com/files/2018-11/bzl_effizient_duengen_-_anwendungsbeispiele_zur_duengeverordnung.pdf*

Sources: *Empfehlungen für wirkungsvolle Kriterien zum Schutz der Biodiversität in Standards für die Lebensmittelbranche und Beschaffungsrichtlinien von Lebensmittelunternehmen: https://www.business-biodiversity.eu/de/empfehlungen-biodiversitaet-in-standards*

Late stubble cultivation

Description of the measure

Late stubble treatment is only carried out after August 15 or, in the case of very late-flowering target species, after September 10. Some rare wild herbs flower in late summer and their seeds ripen on the stubble fallow after the harvest.

Sites with late-flowering weeds and a low incidence of problem weeds are best suited, preferably on sites with low yields.

This measure can also be implemented on parts of a field.

Further recommendations

This measure is generally not suitable for fields that are potentially overgrown with problem weeds.

In the case of a summer crop, it is also advisable to leave the cereal stubble standing throughout the winter.

Effects on biodiversity

Wild herbs in stubble fields provide food for insects, birds, hamsters and hares.

Migrating amphibians are not endangered by tillage.

Further positive effects

Weakly competitive arable weeds are supported, especially late-flowering wild herb species and those that receive a development boost through the long preservation of the stubble.

The ground cover protects the soil from erosion and improves the soil's food web (bacteria, fungi and other microorganisms).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For further reading: *Meyer, S., Hilbig, W., Steffen, K., & Schuch, S. (2013). Ackerwildkrautschutz - eine Bibliographie: Ergebnisse aus dem F+E-Vorhaben (FKZ 3512 86 0300). BfN Bundesamt für Naturschutz.*

Sources: https://www.landwirtschaft-artenvielfalt.de • https://segetalflora.de/schutzaecker • www.lel-bw.de/pb/,Lde/Startseite/Unsere+Themen/Ackerwildkrautaecker
"Ackerwildkräuter erhalten und fördern" - Netzwerk Blühende Landschaft: https://bluehende-landschaft.de/handlungsempfehlung/

Overwintering cover crop

Description of the measure

Cover crops are sown as soon as possible after clearing the previous crop and are grown between two main crops as green manure or for forage use. Alternatively, an undersown crop (see measure sheet „Wide row with flowering undersown crop“) can be sown alongside a main crop, fulfilling the utilization possibilities as well as the ecological and agronomic functions of a cover crop after harvest. The selection of appropriate components depends on various factors, as outlined in the „Flowering cover crop“ measure sheet.

For overwintering cover crops, the focus is on erosion control and preventing nutrient leaching into groundwater during the winter months. Depending on the winter hardiness of the cover crop species and the winter weather conditions, cover crops may continue to grow into spring. Depending on the weather and the type of subsequent crop (e.g., early summer tillage), cover crop species should be chosen that can survive freezing temperatures, or appropriate biomass management options should be available. This is especially important in areas with erosion risks where spring tillage is not permitted.

Winter hardiness is influenced by many factors beyond the choice of cover crop; for instance, stands that are well supplied with nitrogen will freeze faster than hardened stands when temperatures drop sharply without snow cover. In addition, winter hardiness within the species is partially strongly dependent on the variety.

Effects on biodiversity

Cover crops provide habitat and food for insects, among other things, by functioning as a (relatively late) source of pollen or grains and, where appropriate, by reducing nutrient pollution. Overwintering cover crops provide overwintering habitat and shelter for insects and small wildlife, as well as seed stands for birds. Rooting through the cover crop and the subsequent decomposition of biomass increases soil activity.

Further positive effects

Cover crops reduce nutrient leaching and water erosion through root penetration and soil cover. They improve water-holding capacity and soil structure and contribute to the accumulation of humus. Legumes can contribute additional nitrogen to the soil.

Further recommendations

Precipitation should be considered as a key success factor in planning.

Sources: *https://ltz.landwirtschaft-bw.de/,Lde/Startseite/Kulturpflanzen/Zwischenfruechte+und+Untersaaten*

Wide row with flowering undersow

Description of the measure

For the measure „Wide row with flowering undersow“, a cereal field is cultivated at a lower density together with a diverse undersow.

Implementation

- Extended seed row spacing (cereals: 25 - 30 cm, maize 75 cm)
- Sowing density of 70 % of the conventional density
- Sowing time:
  - Summer sowing: simultaneous sowing with main crop
  - Winter sowing: the more competitive the cover crop, the earlier the undersow should be sown so that it can still establish itself
- Spreading or superficial application, then rolling or tamping in
- Reduced and adapted fertilization (fertilization 50-70 % of the otherwise farm/area-specific level); max. N surplus: 10 kg N/ha
- No use of synthetic chemical pesticides
- Under-sowing as an overwintering catch crop or even following main crop (clover-grass)

Location

- Locations with high precipitation levels and good precipitation distribution
- Areas without weed pressure and without root weeds
- No previous biodiversity measures such as flower strips, fallow land or legumes

Undersow mixtures

- Biodiversity mix (80 % legumes, 20 % herbs)
- Green Carbon Fix (70 % grasses, 13 % legumes, 12 % herbs)
- TERRALIFE® - SOIL PROTECT (55 % grasses, 30 % legumes, 15 % herbs)
- Different amounts of clover and grass depending on altitude and precipitation distribution

Effects on biodiversity

The double row spacing and reduced fertilization protect biodiversity in general. Open patches of soil provide breeding habitats for soil-borne insects. When undersown with a diverse, flowering herb mixture, insects benefit from the food supply during the flowering season. In winter, insects can hibernate, small game can find shelter and birds can feed on the seed heads.

Further recommendations

The amount of precipitation must be taken into account for the success of undersowing and stubble sowing. It would therefore be advisable, for example, to plant undersown crops in winter crops with drought-resistant mixtures such as alfalfa instead of red clover and tall fescue instead of cocksfoot.

Further positive effects

In addition to increasing soil fertility, undersown crops generally also serve to improve soil structure and reduce erosion. They help to build up humus and increase water retention capacity. The trafficability of the area is improved, while forage utilization is possible and legumes contribute additional nitrogen to the soil.

Sources: https://www.oekolandbau.de/landwirtschaft/pflanze/spezieller-pflanzenbau/zwischenfruechte/untersaaten • https://orgprints.org/id/eprint/15102/2/Zwischenfruechte.pdf

Wide row with self-greening

Description of the measure

For the „Wide row with self-greening“ measure, a cereal field is cultivated at a lower density and self-greening is made possible.

Implementation

- Locations with high precipitation levels and good precipitation distribution
- Sowing at a lower density, with double seed row spacing or with drill gaps
- Sowing density of 50-70 % per m² compared to conventional density; at field level, partial area or strip form (at least 15 m wide)
- Reduced and adapted (mineral) fertilization (fertilization 50-70 % of the otherwise farm/area-specific level); maximum N surplus: 10 kg N/ha.; or green manure/light organic fertilization possible depending on location
- Avoidance of synthetic chemical pesticides (especially herbicides and insecticides)
- No or reduced mechanical weed control (e.g. harrowing)
- Late stubble cultivation to promote arable wild herbs with late seed maturity and protect amphibians and young hares
- Standing time like the cereal crop

Variants

- Double row spacing: every second drill coulter closed (row spacing of approx. 18 cm)
- Half seed rate: Reduction of the seed rate by 30-50 % when sowing
- Drill gaps: Creation of gaps during sowing by closing seed coulters with a width of 30-50 cm; spacing between the drill gaps: 1-2 m

Various harvesting options

- Normal harvesting and transplanting (transplanting from August 31 at the earliest, ideally leave over winter)
- Normal harvest, then leave stubble fallow (see measure sheet „Late stubble cultivation“)
- Leave extensive cereals standing over winter

Effects on biodiversity

Double row spacing and the associated reduced fertilization generally protects biodiversity. The increase in light incidence promotes arable weed communities, which are a food source for open field species such as insects and field birds and are used by some insects to lay their eggs. In winter, insects can hibernate here, small wildlife can find shelter and birds can feed on the seed heads. Open patches of ground can provide breeding habitats for ground-nesting insects. Ground-nesting farmland birds such as the skylark use open cereal crops as nesting sites.

Further recommendations

The amount of precipitation is crucial for the success of extensive arable and stubble crops. They should preferably be planted on lean land without dominant weeds or on low-yielding sites such as knolls, field margins or sandy sites.

If there is a lack of seed potential in the soil, the variety of flowers in the light strips or cereal gaps can be supplemented by sowing native wild herbs and flowering crop species with low seed rates.

Reducing the seeding rate can lead to yield losses. However, in the case of early-sown winter cereals with good pre-crop values, increased tillering can largely compensate for the losses.

For further reading: https://franz-projekt.de/uploads/Downloads/Massnahmen/Ma%C3%9Fnahmenblatt_Extensivgetreide%20(1).pdf

Sources: https://www.rheinische-kulturlandschaft.de/massnahmen/a4a-extensive-aecker-lichtaecker/

Biodiversity-promoting measures in grassland

Graduated grassland management

Description of the measure

The concept of graduated grassland management is based on the fact that the grassland areas available to a farm are managed with varying degrees of intensity. The management (fertilization & cutting frequency) should take into account the yield potential of the meadow, for example, in addition to other factors. A distinction is made between high-yield and reduced-use management. Yield-focused and reduced-use management should be combined on the farm in such a way that animal welfare, profitability and, at the same time, biodiversity in the meadow habitat are taken into account.

The five cornerstones of „graduated grassland management“ in high-yield grassland use are:

- **High feed quality for animal-friendly and performance-oriented feeding**
- **Withdrawal-oriented nutrient supply of yield-oriented grassland areas**
- **Utilization-adapted plant stands for optimum yields**
- **Nutrient balancing in relation to the entire farm**
- **Traditionally and use-reduced managed grassland areas for nutrient optimization of the high-yield areas and, if necessary, to meet the requirements of nutrient balancing.**

After an analysis of the farm‘s grassland areas, these are transferred into a tier system in order to classify high-yield, intensive areas and reduced-use, extensive areas. In this way, the nutrient balance of the farm as a whole is also balanced.

Effects on biodiversity

With up to 50 plant species, extensively used meadows are among the habitats with a very high level of biodiversity. Hotspot areas can be created and/or preserved through graduated grassland use.

Further positive effects

Wildflower meadows are a cultural asset. They developed from agricultural use into many different types of meadows - depending on the climate, soil type, slope and altitude - from alpine meadows and mountain meadows to wet and fatty meadows, litter and orchard meadows to dry and nutrient-poor grasslands.

Further recommendations

Increasing the number of species takes several years, depending on the location and condition of the area. If there is no seed potential, a species enrichment measure can be considered (see grassland measure sheet: Species enrichment in grassland).

As the system is very individual to each farm, it is advisable to visit an experienced farm with graduated grassland management. Advice can be sought on the classification of the areas.

For further reading: https://www.fibl.org/fileadmin/documents/shop/2021-abgestufter-wiesenbau.pdf

Sources: *Dietl, W., & Lehmann, J. (2004). Ökologischer Wiesenbau: Nachhaltige Bewirtschaftung von Wiesen und Weiden (1. Aufl.). Österreichischer Agrarverlag:* https://www.bund-naturschutz.de/natur-und-landschaft/wiesen-und-weiden-in-bayern/lebensraum-wiese

Agroforst – Integration of tree rows on pastureland

Description of the measure

If rows of trees are integrated into grazing areas, weather-related influences that have a negative impact on animal welfare can be mitigated. Especially in summer, the shade cast by rows of trees provides cooling. Suitable tree species include all fruit trees, willows and poplars, but also oaks, lime trees and maples. If the trees are to produce additional fodder, long-term planning is required.

Location

It is essential to match the site characteristics with the site requirements of the tree species. No tree species should be selected that cannot tolerate the climatic conditions in open spaces (strong sunlight, heat, late frosts). If possible, only regional and certified origins should be used. Conifers (with the exception of junipers) and exotic tree species should be avoided as far as possible due to a lack of functionality or lack of knowledge about their ecological effects.

Implementation

- Machine-compatible distances between the tree strips
- Distance within the row: 4-8 m
- If the soil is heavily compacted, deep trenching may be necessary
- Planting of bare-root or balled and burlaped young plants, cuttings also possible for willows and poplars
- Installation of resilient/permanent individual tree protection against browsing by grazing livestock

Management

- Regular (at least annual) inspection of the vitality of the trees
- Replanting failed trees
- Protection of new plantings from grazing livestock, e.g. by electric fences or robust individual protection measures
- Watering young trees/cuttings during prolonged dry periods
- Cutting the trunks (removing all branches up to a certain height) or topping (topping the trees at a certain height, which should be well above the grazing animals‘ branches) for additional foliage feed (especially for poplar and willow) with subsequent regular repetition for permanent stabilization of the trees

Effects on biodiversity

Agroforestry systems bring about a significant and lasting increase in structural and habitat diversity. With the right choice of tree species (especially roses), they provide flowers, nectar and pollen for wild bees, bumblebees and other insects. They also serve as a refuge for various animal species during agricultural work and as a habitat for field birds and small mammals.

Further recommendations

Attention should be paid to the origin of the planting material and, where possible, only regional and certified plants should be used.

Further positive effects

Leaf fall and root growth on the wooded strips lead to a substantial accumulation of humus and thus to an improvement in the soil. At the same time, agroforestry systems protect agricultural land from drought and wind erosion. They thus mitigate the consequences of climate change and relieve the burden on irrigation systems in the future.

In addition, fallen fruit and tree leaves are an additional source of feed for livestock that can mitigate or prevent diseases (intake of various secondary plant substances that have a positive effect on parasitism and rumen fermentation). If the quality of the animal products increases as a result of the measure, it is realistic that they can be marketed at a higher price. With the appropriate choice of tree species and care, further products can be produced in marketable quantities. The production of valuable timber is also realistic in the long term.

For further reading: https://agroforst-info.de **Sources:** https://agroforst-info.de/wp-content/uploads/2021/12/2021_DeFAF_Broschuere_2-web.Aufl_.pdf

Old grass strips / insect protection strips

Description of the measure

Old grass and insect protection strips preserve and provide habitat and food for insects.

Implementation

- No mowing of parts or strips on 5-20 % of the field
- At least 5 m wide; 10 m if nests of ground nesting birds are present to avoid predators
- Leaving a new strip with each cut, mowing off the old strip
- Alternatively: Stand for 1 year, then look for a relocation with other structures
- Last cut of the year is particularly important, with the widest possible strips (overwintering habitat for insects and other animals)
- Spread the areas or strips over the entire field (e.g. a strip of 5-10 m every 100 m); in the vicinity of bodies of water or on diversely flowering hilltops
- Ideally, plant them next to other insect-promoting structures such as bushes, hedges or other woody elements

Effects on biodiversity

Unmown grassland strips/parts allow herbs in the grassland to bloom. This creates a small hotspot for flower-visiting insects that feed on nectar and pollen. Grasshoppers and butterflies also find breeding and refuge here.

Further positive effects

Old grass strips contribute to biotope connectivity and structural enrichment and provide protection and cover for animals.

Further recommendations

Problematic weeds, such as thistle, can be removed locally. On the other hand, thistles are important food plants for butterflies. It is therefore not desirable to have completely „clean“ areas. An individual approach must be agreed for other problem plants. If giant hogweed *(Heracleum mantegazzianum)* or Canadian goldenrod *(Solidago canadensis)* is present, a strip of old grass is not advisable.

For further reading: https://www.rheinische-kulturlandschaft.de/massnahmen/g4-altgrasstreifen-ueberjaehrige-streifen-und-flaechen/

Sources: https://franz-projekt.de/uploads/Downloads/Massnahmen/Ma%C3%9Fnahmenblatt_Altgrasstreifen%20(1).pdf • https://www.kulturlandschaft.nrw/project/altgrasstreifen/

Creation and maintenance of orchards

Description of the measure

Orchard meadows involve the cultivation of fruit on high-stemmed tree forms (= trunk height of at least 1.80 m) using environmentally friendly management methods for the entire area. The undergrowth is extensively cultivated as meadow and/or pasture and only fertilized to the extent necessary so that a grassland rich in flowers and insects develops and is maintained. This goes hand in hand with the fact that neither the undergrowth nor the fruit trees are treated with synthetic fertilizers or insecticides.

As part of this measure, new orchard meadows are to be created and existing, partially overaged and/or abandoned stands are to be revitalized and restored to a usable state. Maintenance and utilization concepts must be designed for the long term in order to establish long-lasting, vital stands. The fruit tree population in the individual areas should be as species- and variety-rich as possible.

Implementation of replanting and new planting

- High-stemmed, strong-growing, robust varieties from regional nurseries
- Minimum spacing between trees and rows: Apple/pear 12 m, plum-like 10 m, sweet cherries/grafted walnuts 15 m, cider pear/service tree/chestnut 20 m
- Preferably autumn planting (so that rooting is possible before budding), but as a rule of thumb possible from the beginning of leaf fall to new leaf emergence
- The later the planting date, the more watering is required in the following summer months

Effects on biodiversity

Orchard meadows are among the most species-rich habitats in our cultural landscape and contribute to the structural diversity of the landscape.

Up to 5000 animal and plant species benefit from habitat elements from forests and open land as well as a high food supply from flowers and other food sources. Many bird, beetle and butterfly species threatened with extinction find food, breeding and nesting sites.

Further positive effects

Orchards are a formative component of the rural cultural landscape and contribute to people's nutrition. In addition, orchards represent a genetic reservoir for the preservation of old and regional fruit varieties, which is essential for the future adaptation potential and resilience of fruit trees, especially with regard to changing climatic conditions.

In the peripheral areas, orchards can be complemented by species-rich hedges and fringe structures, thus contributing to the diversity of the landscape.

Further recommendations

When planting new orchards, only as many fruit trees should be planted as can actually be used and cared for by experts.

Professional planting planning (including selection of tree varieties) and good training of the young trees are particularly crucial for the long-term success of the measure. **Successful planting includes:**

- installing vole protection baskets
- tie the young tree to at least one stake
- installation of browsing protection (type of protection is determined by the underutilization).

Extremely dry areas or areas with stagnant moisture such as hollows or moorland are unsuitable for orchards.

During maintenance work, some of the deadwood and prunings should be left in the plants as a habitat for birds and insects insofar as this is possible (statics of the tree, traffic safety). Deadwood of all types and sizes provides a valuable habitat for a variety of insects and other animals.

For further reading: *Thüringer Streuobstwiesenkonzept (2020): https://umwelt.thueringen.de/fileadmin/Publikationen/Publikationen_TMUEN/Streuobst_Final.pdf*

Sources: *https://umwelt.thueringen.de/fileadmin/Publikationen/Publikationen_TMUEN/Streuobst_Final.pdf • https://www.nabu.de/natur-und-landschaft/landnutzung/streuobst/index.html https://www.dvl.org/uploads/tx_ttproducts/datasheet/DVL-Publikation-Praxisheft_Hinweise_zur_Biotop-_und_Landschaftspflege-Streuobst.pdf*

Species enrichment in grassland

Description of the measure

Increasing species diversity in grassland promotes a continuous supply of flowers throughout the year and increases the structural diversity of the landscape.

Various methods are recommended depending on the size of the area and the availability of a suitable donor area.

Implementation

- Selection of a donor area as close as possible to the recipient area for a meadow sward in cooperation with the farmer, Nature Conservation Authority and/or agricultural authority with vegetation suitable for the recipient area (moisture/ soil conditions)
- On smaller areas, meadow threshing in standing crops is possible with the help of a meadow seed harvester
- Preparation of the recipient area after the first cut: milling and rolling of strips on approx. 25% of the area or repeated sharp harrowing of the area
- Transfer of mowed material of the first cut of the donor area (time of highest seed maturity of the target species), mowing early in the morning, transportation to the area and spreading of the mowed material as a 3-5 cm thick layer
- Alternatively, threshing and drying the mowed material: enables a wider range of species by combining different meadows and cutting times; can be spread manually on areas that are difficult to drive on
- Post-processing of the recipient surface: Rolling (no training!)
- In the following year: 2-3 cuts, adjusting the cutting times to the seed maturity of the target species to allow the newly introduced species to spread
- The „number of species per 25 m²“ or „m² of species-enriched area“ can be used as an indicator of the success of the measure.

Effects on biodiversity

The enrichment of species promotes plant and structural diversity, which serves as habitat and food for numerous insects. The presence of rarer plants, for example, enables the colonization of specialized butterflies. The resulting increase in insects provides an improved food source for bird fauna and small mammals.

Further positive effects

Furthermore, soil structure and humus build-up are promoted. The species-rich mixtures contribute to the promotion of soil life through different root formation, depth and excretions. The area is also visually enhanced.

Further recommendations

If there is an increased occurrence of problem weeds (e.g. dock), action must be taken to prevent the area from being devalued. Appropriate measures should be taken for individual control or a cupping cut in late summer or before the seed heads form.

If no suitable donor area is available, strip seeding with regional seed that is suitable for the respective area of origin should be considered. Where grassland may not be plowed up, it may be possible to sow without plowing.

Seeds can be lost when drying mowed material. It is advisable to place a cloth underneath to catch the seeds.

For further reading: https://www.lfl.bayern.de/mam/cms07/publikationen/daten/informationen/artenanreicherung-wirtschaftsgruenland-leitfaden-praxis.pdf
https://www.natur-im-vww.de/service/wildpflanzen-praxistipps/umbruchlose-ansaat/

Sources: https://www.lfl.bayern.de/mam/cms07/publikationen/daten/merkblaetter/artenareicherung-im-wirtschaftsgruenland_lfl-merkblatt.pdf • https://www.lfl.bayern.de/mam/cms07/publikationen/daten/schriftenreihe/transfer-artenanreicherung-wirtschaftsgruenland_lfl-schriftenreihe.pdf • https://naturschutzbund.at/files/NATUR%20VERBINDET/Maehgutuebertragung.pdf
http://mahdgut.naturschutzinformationen.nrw.de/mahdgut/de/fachinfo • https://www.bdp-online.de/de/Branche/Saatguthandel/RegioZert/ • https://www.natur-im-vww.de/wildpflanzen/vww-regiosaaten/
http://mahdgut.naturschutzinformationen.nrw.de/mahdgut/de/fachinfo/methoden/drusch

Insect-friendly mowing

Description of the measure

In addition to fertilization, cutting frequency and pesticide use, mowing is crucial for biodiversity in meadows and other grassland areas. The extent to which mowing is insect-friendly is determined by various factors. Taking each individual factor into account can already reduce the risk of injury to insects. In order to achieve the greatest possible reduction in insect losses, as many factors of this measure as possible should be implemented.

Implementation

- Use of cutter bars (finger bar/double blade technology), alternatively rotary mower (disadvantage: high rotational speed and driving speed)
- No mulching or conditioners (insects are chopped and crushed together with clippings)
- High cut at min. 8 cm
- Low mowing speed for better chances of escape; rotary mowers are faster for technical reasons (recommendation: max. 10-15 km/h, otherwise strong suction effect for insects)
- Early summer & late summer: mowing at midday in sunny weather from 12 - 2 p.m.; midsummer: mowing in sunny weather from 11 a.m. - 4 p.m., as insects are particularly mobile here.
- Alternatively: mowing when the sky is overcast and temperatures are cool, as fewer flower-visiting insects are on the move then
- Mowing from the inside out for better chances of escape

Further positive effects

A high cut protects soil life and numerous leaf rosettes (especially of herbs), which improves their ability to regenerate. A variety of other animals such as birds (e.g. meadow breeders), amphibians and small mammals also benefit from the individual factors of insect-friendly mowing.

Further recommendations

Mowing in sections and leaving partial areas standing (mosaic mowing) contributes to biotope networking and structural enrichment (see measure sheet on old grass strips/insect protection strips).

Sources: https://www.natuerlichbayern.de/fileadmin/user_upload/Praxisempfehlungen/Praxisempfehlungen_Insektenschonende_Mahd.pdf

Becker, N., Muchow, T. & Schmelzer, M. (2019). AgrarNatur-Ratgeber – Arten erkennen – Maßnahmen umsetzen – Vielfalt bewahren (Hrsg. Stiftung Rheinische Kulturlandschaft), Bonn, 220 S.

Biodiversity-promoting measures in fruit farming & viticulture

Alternating mulching of driving lanes

Description of the measure

If the driving lanes in orchards and vineyards are frequently and regularly mowed, hoed or mulched, insects, birds and small animals will hardly find flowering plants and retreats.

Alternating mulching of the driving lanes ensures that flowering herbs and refuges for insects and other animals such as grasshoppers are continuously present in the plant. For this purpose, only every second driving lane is mulched per mulching pass.

Alternating mulching of the driving lanes is useful between the beginning of April and the end of August at intervals of about 5-6 weeks.

Effects on biodiversity

Alternating mulching gives vegetation in the driving lanes the opportunity to come into flower - and depending on the plant and the rotation of mowing - to seed maturity, so that plant diversity can be promoted. This provides insects with a continuous source of nectar and pollen throughout the growing season. The driving lane vegetation provides refuge and habitat for insects, birds and other small animals.

Further positive effects

Increased ground cover protects the soil from erosion. It also encourages beneficial insects and pollinators, which can lead to reduced use of pesticides.

Further recommendations

Ideally, this approach is combined with the measure „Species-rich driving lanes“ so that the flowering aspect can develop well in the driving lanes. This promotes insects and wild herbs in the long term and mice populations can be kept under control.

For further reading: https://www.oekolandbau.de/forschung/foerderung-der-biodiversitaet-in-obstanlagen/ • https://www.business-biodiversity.eu/de/biodiversitaet-im-weinbau

Sources: *FiBL (2016): Handbuch: Biodiversität auf dem Landwirtschaftsbetrieb: https://www.fibl.org/de/shop/1702-handbuch-biodiversitaet*

Species-rich drive row greening

Description of the measure

Species-rich drive row greening offers a solution to drought, erosion and pest problems and provides food and habitat for insects.

Implementation

- Self-vegetation or, if there is little plant diversity in the existing vegetation, sowing of (low) flowering mixtures with 20-30 native wild herbs (exclusively local/autochthonous seeds to prevent so-called flora falsification)
- Adapted mowing management: extend or raise the middle mulching blade (>7 cm), for low flower strips in the middle of the drive row
- Mowing recommended in early/mid-May
- Ideally in combination with the „Alternating mulching of drive rows“ measure

Effects on biodiversity

A variety of flowering plants in the drive rows provides insects with a continuous source of nectar and pollen throughout the growing season. It also creates habitats for insects and other animals. This promotes insects and wild herbs in the long term and mice populations can be kept under control.

Further positive effects

The species-rich greening of drive rows offers additional protection against erosion and improves trafficability. It also promotes humus formation and thus soil life. The measure is also an active pollination management measure, as it promotes wild bees and beneficial insects that are more independent of the weather.

Further recommendations

When applying pesticides, and especially products that are harmful to bees, strong flowering aspects in the drive row can lead to pollinating insects being unnecessarily exposed to these products. The drive rows should therefore be mowed before plant protection treatments.

For further reading: https://www.oekolandbau.de/forschung/foerderung-der-biodiversitaet-in-obstanlagen/

Sources: https://www.nabu.de/imperia/md/content/nabude/biodiv/160331-nabu-massnahmensammlung_tafelobst.pdf

Flowering shrubs and nesting trees as anchor plants

Description of the measure

The planting rows in an orchard or vineyard offer the possibility of planting a shrub at the beginning and end of each row and at the bracing of hail nets.

Implementation

- At the beginning and/or end of each row instead of a fruit tree or at a distance of just under one meter from the last tree
- Usually rose plants (additional function as indicator plants for disease and pest infestation)
- Alternative: native, low-maintenance, not too vigorous shrubs with non-double flowers and without runners
- No intermediate or main hosts of fire blight or plants that favor pests and pathogens of fruit trees
- Woody plant recommendations: Prunus, buckthorn, privet, wild raspberry, black elderberry, common viburnum, common snowball, honeysuckle or cornelian cherry (the last two not for cherry orchards because of the cherry fruit fly!)
- Wood maintenance during pruning of the plant

Effects on biodiversity

Flowering shrubs provide a wide range of nectar and pollen for numerous insects and, depending on the shrub, fruit as winter food for birds. In addition, breeding opportunities are created in (thorny) copses for free-breeding birds (blackbirds, greenfinches, chaffinches, goldfinches, goldfinches).

Further positive effects

Beneficial organisms are encouraged, which ideally leads to a reduction in the use of pesticides.

Further recommendations

It is helpful to protect the shrub with a wooden stake so that the plant is not injured during soil cultivation. This is not necessary when planting on the bracing of hail nets.

To promote breeding opportunities for free-nesting birds, whorls of branches should be created or existing whorls left in place during pruning.

Sources: *https://www.nabu.de/imperia/md/content/nabude/biodiv/160331-nabu-massnahmensammlung_tafelobst.pdf*

Cultivation of PIWI grape varieties

Description of the measure

PIWI vines (german: PIlzWIderstandsfähige Rebsorten) have a high resistance to fungal diseases such as powdery and downy mildew and allow a significant reduction in the use of pesticides. The robust and innovative grape varieties are thus an obvious alternative to conventional intensive plant protection. Depending on the age and economic viability of the vineyards, good consideration should be given to whether a PIWI variety can be considered for the area when planting a new vineyard. When choosing the newer varieties, the marketing of the not yet well-known wine varieties should be considered.

Examples of PIWI wine types are: Regent, Baron, Monarch, Prior, Johanniter, Muscaris, Bronner, Solaris, Cabernet Cortis, Cabernet Carbon, Cabernet Carol and Cabernet Cantor.

Effects on biodiversity

In viticulture, considerable amounts of plant protection products are applied against powdery mildew fungi in order to prevent possible fungal infestation and to safeguard the harvest. Due to the resistance and robustness of PIWI varieties against plant diseases, the use of chemical synthetic pesticides (esp. copper sulfate & fungicides with particular risk potential) can be greatly reduced, in some cases treatment with baking soda and clay is sufficient.

Further positive effects

Saving on plant protection treatments reduces soil pollution and strengthens the complex soil life of plants, fungi and microorganisms. Depending on the variety and rainfall conditions, two to four treatments in the period before to after flowering are sufficient to ensure high yield security and quality together with the plant's natural defenses. This extensification in crop protection not only results in lower crop protection costs, it also increases the credibility of organic production thanks to the complete absence of copper.

In addition, vines are bred for later budbreak so that they do not tend to flower and ripen earlier and earlier with climate change. This should be considered when planting new vines to adapt to climate change.

Sources: *piwi-international.de/ueber-piwi/piwi-nachhaltig/#oekologisch* • *sibbus.com/de/sortenbeschreibungen/piwi-sorten.html* • *www.delinat.com/piwi.html*

Species-rich fallow before new planting

Description of the measure

After clearing an orchard or vineyard, fruit trees or vines are not always replanted immediately afterwards. In some cases, the required planting material is not available, and sometimes seeding makes sense for soil recovery and improvement. In this case, fallow planting with a species-rich flower mixture is an option.

Careful soil cultivation and sowing is the best prerequisite for an even emergence, good soil cover and a versatile stand. More details are described in the measure sheet „Flowering insectary strips“.

Effects on biodiversity

This measure creates an additional food supply of pollen and nectar for flower-visiting insects (wild bees, bumblebees, butterflies, beetles). In addition, perennial flowering areas provide feeding, breeding and cover habitats for other wildlife (birds, mammals, etc.) and create agro-ecological niches for biodiversity agricultural landscapes.

Further recommendations

Plants particularly suitable for flower visitors are all clovers (Red, Persian, crimson, Egyptian, white, alsike and sweet clover), phacelia, buckwheat, mustard, oil radish and native herbs such as ribwort plantain, caraway or meadow sage. The more diverse a mix, the better! From a nature conservation perspective, native seeds should be used whenever possible.

Further positive effects

If legumes such as clovers, peas or vetches are included in the flowering mixture, the nitrogen supply for the following crop is improved. If deep-rooted crops such as oil radish are also sown, this helps to loosen the soil. The sown biomass covers the soil, improves water infiltration, reduces surface runoff and thus soil erosion. In addition, the plant mass causes humus formation and promotes soil life. Furthermore, the measure is an active pollination management, because especially wild bees and beneficial insects, which are more independent from the weather, are promoted. In addition, the cultivated landscape is not only ecologically but also visually enhanced by such attractive fallow plantings.

For further reading: https://bienenkunde.uni-hohenheim.de/fileadmin/_migrated/content_uploads/bachbegruenung.pdf

Sources: https://www.nabu.de/imperia/md/content/nabude/biodiv/160331-nabu-massnahmensammlung_tafelobst.pdf

Biodiversity-promoting structures

Planting and maintenance of hedges

Description of the measure

The maintenance of existing hedges is particularly important in order to preserve their ecological functions. If there is little capacity, it is better to maintain existing hedges instead of planting new ones.

Maintenance

- Every 3-5 years in the winter months, prune in sections (max. 1/3 of the hedge): 20-30 cm above the ground with smooth diagonal cuts
- Adjust the intensity of pruning to the vigor (fast, weak) of the trees and shrubs
- Omitting outstanding trees
- Include the fringe area in mowing every 1-3 years (without mulching)

New planting

- Ideally parallel to the agricultural working direction and embankments/ field boundaries
- Adapt the choice of trees and shrubs to soil and climatic conditions (e.g. acidity and lime content) (autochthonous native species)
- 2-3 row structure with 1-2 tree species or up to 8 shrub species
- Group plantings of the same species (3-5 plants)
- Approx. 10 m wide, incl. 2 m wide hem on both sides
- Wind permeability of the hedge 40-50%
- bushy planting (resulting in a longer hedge edge)

Effects on biodiversity

Hedges are important elements of the landscape. They provide nesting, breeding and refuge sites for insects, small game, birds, reptiles and amphibians. They are stepping stones for biotopes and stabilize the ecosystem.

Further positive effects

Hedges provide erosion protection on embankments and stream banks, regulate the water balance and help to reduce or prevent the input of substances into bodies of water. They also regulate the climate, act as wind and sight screens and promote biological plant protection.

Further recommendations

The protection of farmland birds (e.g. skylark, curlew) should be taken into account when planning hedges, as conservation objectives may conflict here. Financial support should be clarified within protected areas.

For further reading: *Fachinformation Hecken: https://www.lrasha.de/fileadmin/Website/Dateien/06_Natur_Landschaft/Landschaftserhaltungsverband/Heckenbroschuere_Auflage2.pdf*

Sources: *www.lrasha.de/natur-landschaft/landschaftserhaltungsverband*

Rock and deadwood piles

Description of the measure

Rock and deadwood piles are valuable and simple measures to encourage insects, amphibians and reptiles. They are best planted in sunny but wind-protected edge areas.

Implementation of a rock pile

- Locally typical rock, ideally from fields in the region
- 80 % of the material with grain size of 20-40 cm; the rest can be finer or coarser
- Volume of at least 2-3 m³, ideally 5 m³ or more
- Stones poured/layered on the ground, size and shape of the pile variable
- Frayed edge of pile for wide transition between vegetation and stones (perennial herbaceous margin interspersed with stones).

Implementation of a deadwood pile

- Wood/hedge cuttings of various lengths and diameters from the surrounding area layered or piled (no treated wood)
- Diameter of 1.5-2 m, height at least 1.5 m
- Herbaceous margin of at least 50 cm at edge areas

Maintenance

- Avoidance of overgrowth (free cutting as needed)
- Bushy vegetation on the side of the piles away from the sun can be preserved
- Avoidance of pesticides and fertilizers, ideally also within a radius of 3 m

Effects on biodiversity

Rock piles are dry and warm habitats and thus important biotopes for native species. They serve as hiding places, basking sites, and winter quarters for many different heat-dependent animals such as insects, lizards, and slow worms. They also serve as hunting habitats for nocturnal insects and reptiles and as habitat for heat-loving plant species. Larger holes near the ground are also used by mammals.

Woodpiles provide nesting, development, overwintering, and hiding opportunities for various specialized beetles and larvae that feed on deadwood, as well as beneficial insects that colonize deadwood. Other insects, amphibians and reptiles, and small mammals use deadwood piles as winter roosts.

Further positive effects

Small predators such as martens, foxes, and weasels benefit from rock and deadwood piles and can help control pest rodents. Amphibians and reptiles such as toads, sand lizards and slow worms feed on pests. Overall, this measure can also help reduce the use of pesticides.

Further recommendations

The wood should be checked for pests such as elm splitting beetles or bark beetles before piling to avoid spreading into surrounding forests.

For further reading: https://www.landwirtschaftskammer.de/landwirtschaft/naturschutz/biodiversitaet/lesesteine/index.htm

Sources: https://www.landwirtschaft-artenvielfalt.de/die-massnahmen/das-naturschutzmodul/landschaftselemente/l-10-lesesteinhaufen-steinwaelle/
https://www.nabu.de/umwelt-und-ressourcen/oekologisch-leben/balkon-und-garten/grundlagen/elemente/25136.html

Flower strips and areas

Description of the measure

Flower strips are defined as the cultivation of annual, biennial or perennial flower mixtures over a wide area or in strips at least 3 m wide. They can be planted on any area (e.g. edges of fields or woodland, border areas, unfavorably cut areas) without rare arable weeds or potential risk of problem weeds.

Seeds

- Perennial autochthonous mixtures for greater species and structural diversity, i.e. different heights and flowering times/duration
- The more plant species in the mix, the better for insects due to different flowering times and structures
- Selection of species with high competitiveness against problem weeds

Sowing

- Preparation of a fine-grained but firm seedbed
- Sowing with combined/simple seed drill or fertilizer spreader
- Must not be sown too densely for light-demanding species
- Rolling the seeds improves soil contact and germination
- Sowing in fall or spring for perennial mixtures: Autumn sowing brings the first flowers in spring, but a lower proportion of colorful annuals / spring sowing brings a more colorful flowering aspect in the first year of growth
- For annual mixtures, sow in spring (end of April - mid-May)

Maintenance

- No use of pesticides or fertilizers
- No mowing for annual mixtures
- Single mowing for perennial mixtures (do not mulch), if possible with 10-15% of unmown area retained as a refuge
- Mowing perennial mixtures (not mulching): a maintenance cut can be carried out on 50% of the area from the second year of establishment before April 1, the remaining 50% should be mowed from August 1. Change the maintenance areas in the following year.
- Selective, manual mowing or weeding is important if individual problem weeds dominate
- Maximum possible mowing height, at least 10 cm from the ground
- Avoid mowing when the soil is wet (leads to compaction)
- Removal of the mowed material (matting of the area prevents the germination of wild herbs)

Effects on biodiversity

Flowering areas provide flowers, nectar and pollen for wild bees, bumblebees and other insects. They support beneficial macro- and micro-organisms. During agricultural work, they serve as a refuge and also provide hibernation habitats for insects, birds and small game.

Further positive effects

Flowering areas provide natural pest control through the increase in beneficial insects. This can reduce the use of pesticides. They contribute to biotope networking if they are laid out in such a way that they connect forest edges, field edge structures and meadows. Soil improvement and humus build-up are favored. In species-rich mixtures, different root formation, depth and exudation contribute to the promotion of soil life. In addition, the water storage capacity of the soil is improved and the field is visually enhanced.

Further recommendations

Flower strips offer a good preceding crop effect for cereals or maize. Care should be taken with the later sowing of legumes or rapeseed.

In principle, it should be noted that this measure should not be considered in isolation. Edge structures, hedges, fallow land and diverse crop rotations also contribute to the reduction of harmful organisms and provide valuable overwintering habitats for beneficial organisms.

Especially when sowing perennial seed mixtures, there is a risk that the dominance of grass and weeds will progress instead of flowering aspects. Additional mowing can help to reduce weed pressure. Problem weeds such as thistles should be mowed separately with a brush cutter to prevent them from going to seed.

Important to know: The visual and ecological appearance of flowering areas can vary greatly. A certain amount of grass is tolerable.

Sources: https://www.fairpachten.org/fileadmin/user_upload/Dokumente/PDFs-Ma%C3%9Fnahmen/MehrjaehrigeBluehstreifen_Fairpachten.pdf • https://www.anl.bayern.de/publikationen/anliegen/doc/an41129dietzel_et_al_2019_bluehstreifen_review.pdf • https://franz-projekt.de/uploads/Downloads/Massnahmen/Ma%C3%9Fnahmenblatt_Mehrj%C3%A4hrige%20Bl%C3%BChstreifen%20(1).pdf https://franz-projekt.de/uploads/Downloads/Massnahmen/Ma%C3%9Fnahmenblatt_%C3%9Cberj%C3%A4hrige%20strukturreiche%20Bl%C3%BChstreifen.pdf

Design and maintenance of riparian strips

Description of the measure

Riparian strips run along streams, rivers or other bodies of water and serve to protect the water from substance inputs. At the same time, they can also promote biodiversity.

Implementation

- At least 10 m wide and up to 50 m long
- Promotion of natural vegetation and the development of shrub-like structures (no or only extensive cultivation)
- Alternative: extensively managed grassland or clover grass
- No use of fertilizers and pesticides
- In the case of extensive management: alternate mowing of the two riparian strips (i.e. one year on one side and one year later on the other) or multi-year rotation

Effects on biodiversity

Wide, diverse vegetation strips along water bodies serve as a buffer zone between cultivated land and natural ecosystems/water bodies. Preventing nutrients and pesticides from entering the water is the most important effect of riparian strips. In addition, riparian strips provide protection and refuge for insects, hares and partridges during agricultural work in the fields.

The areas are habitats and hibernation areas for many insects. This vegetation is particularly important for the development of many dragonflies and butterflies. Riparian strips also serve as stepping stones and connect open landscapes for butterflies, grasshoppers and other insects.

Further positive effects

Using riparian strips to improve habitat quality for various wildlife can be a win-win situation.

Riparian strips are a very important instrument for preventing the eutrophication of water bodies and are therefore a key measure for human health.

The permanent vegetation cover generally contributes further to erosion control, especially on steep embankments.

Further recommendations

Native shrubs and trees on the edge of watercourses should be maintained as part of good agricultural practice. Regular maintenance can prevent the invasion of problem weeds or pests.

Legal note: According to EU regulations, a watercourse edge strip at least 5 meters wide must be created. It is necessary to remove a strip of this width from agricultural use. In Germany, riparian strips outside built-up areas must be at least 10 meters wide. As the use of pesticides and fertilizers is not permitted, these areas are low-yield sites and can therefore be valuable locations for the implementation of biodiversity measures.

Sources: https://www.landwirtschaft-artenvielfalt.de/ • https://dejure.org/gesetze/WHG/38.html

Sand beds – Open soil spots

Description of the measure

Sand beds are open ground areas that provide nesting habitat for ground-nesting insects. In particular, dry sandy areas with little vegetation and sunlight are vital nesting structures for a variety of bee species. It is often sufficient to create or maintain patchy vegetated or vegetation-free ground areas.

Implementation

- 2-3 m wide strip of raw soil
- Best on sandy soils (spreading sand at the edge of the field is not advisable)
- Ideally adjacent to linear structures such as borders, hedges, or other shrubs or flower strips
- No use of pesticides and avoid drift

Effects on biodiversity

50 % of wild bee species nest in the soil. If we add the cuckoo bees of the ground-nesting bees, the larvae of 75 % of the bee species develop in the soil.

Further positive effects

The areas serve as stepping stones and connect open landscape features for wild bees, grasshoppers, and other insects.

Further recommendations

The measure can be well implemented in conjunction with the creation of so-called „biodiversity islands“ (consisting of native shrubs, wood and rock piles, near-natural vegetation, etc.).

Many species of wild bees ignore sandy areas smaller than 0.5 m². The larger the area, the more attractive it is for most of the ground-nesting bees, many species of which like to live in colonies. Some species breed at depths of up to 50 cm. Therefore, the depth of the sandarium should also be thought through. Artificially created break-off edges in the terrain or heaped-up embankments are also readily and quickly accepted as nesting sites by wild bees (among others) and do not grow over so quickly.

For further reading: https://ebooks.wildbee.ch/erdnister/mobile/index.html#p=35

Sources: https://wildbiene.com/standard/content.php?am=3&as=125&am_a= • https://ebooks.wildbee.ch/erdnister/mobile/index.html#p=35

Hem on arable land

Description of the measure

An extensively used fringe serves as a transitional area between different habitats and creates connections between structural elements.

Implementation

- 3-10 m wide
- Shallow, stony, sandy and dry to moist sites in sunny locations
- Ideal along embankments, ditches and plot boundaries, on slopes as erosion protection
- If possible, plow in the fall or at least one month before sowing
- Preparation of fine-crumb seedbed: harrow approx. 10 cm deep after winter, harrow increasingly superficially 2 to 3 times at two-week intervals before sowing
- Sowing as surface broad sowing with a sowing machine or by hand in mid-April to the end of May immediately after the last tillage, then directly rolled on
- Do not drill in and do not sow cover crops

Maintenance

- 1-2 clearing cuts 8-10 cm above the ground as soon as weeds begin to close in places
- Alternate mowing of half of the fringe once a year from mid-August; cut at least 10 cm high near bodies of water to protect amphibians and reptiles
- Carefully rake the clippings (e.g. with a motorized mower with a single-grass device) and remove them if possible (alternatively pile them up in large heaps in the field)

Effects on biodiversity

Field margins provide a rich, year-round supply of pollen, nectar and seeds as well as reproduction, stepping stone and connectivity habitats for insects and birds. They are important retreats and hibernation sites for many insects and small animals (e.g. brown hares), which are protected from frost in the soil of the edges. They also provide breeding grounds for ground-nesting birds such as skylark and stonechat.

Further positive effects

Edges encourage beneficial insects and thus contribute to natural pest control. They also encourage pollinators such as wild bees and thus improve the natural pollination of wild and cultivated plants in the surrounding area.

On slopes, they contribute to erosion control and can reduce the drift of pesticides and fertilizers along water-courses or to neighbouring plots.

Further recommendations

Care should be taken to ensure that the segetal flora is preserved on poor soils. On medium and rich soils, regional, certified seed should be used. Edges should not be sown on compacted and boggy soils or areas with many ryegrasses or problem plants such as thistles, couch grass, bindweed and neophytes; the same applies along busy roads or heavily used footpaths.

In addition, undesirable species such as hackberry or neophytes should be regularly checked for and, if necessary, cut out (organic farms) or controlled with herbicides in single-stock treatments. The majority of spontaneously growing shrubs should be uprooted, although individual specimens can be retained as breeding sites for birds.

Borders should not be confused with the herbaceous border of hedges! The border on arable land is created by seeding and can only be created on arable land. Due to the high proportion of grasses in the mixture and regular cutting, the risk of weeds is low in arable field margins and is therefore well suited to organic farms.

For further reading: https://www.agridea.ch/de/

Sources: https://www.fibl.org/fileadmin/documents/shop/1702-handbuch-biodiversitaet.pdf • https://opac.dbu.de/ab/DBU-Abschlussbericht-AZ-34951_01-Hauptbericht.pdf

Biodiversity-promoting measures in gardens

Low-maintenance front gardens without gravel

What is it about?

Front yards can be low maintenance even without gravel areas, while providing food and habitat for insects.

Recommendations for low-maintenance front gardens

To keep maintenance to a minimum, plant evergreen ground covers with individual prostate shrubs. The planting of flower meadows/herb lawns is particularly suitable in sunny, nutrient-poor locations.

The more maintenance time that can be invested, the more creative the design of the additional perennial planting can be.

Ideally, use a variety of perennial, native plants without double flowers to provide insects with a rich pollen and nectar supply. If possible, use plants of regional origin from organic cultivation. Perennial, regional seeds are preferable for seeding.

Background

Gravel surfaces are not only hostile to nature, they are also, contrary to what is assumed, only easy to maintain in the short term: after a few years, plant parts form enough humus so that initial colonizers such as frugal grasses, tree seedlings, mosses, etc. cannot establish themselves.

In contrast to sealing, plantings make a valuable contribution to temperature regulation: while leaf surfaces cool the environment through the evaporation of water, stone surfaces store heat and continue to radiate it into the night.

Further recommendations

Use peat-free soil. It is best to apply only a compost/humus/sand mixture (in a ratio of 1 to 2), because native wild plants are true survivors and are adapted to nutrient-poor soils. The richer the soil, the greater the potential for weeds.

Front yards can be additionally enriched with nesting aids and/or small watering holes to make this habitat even more insect-friendly.

For further reading: *„Blütenparadiese statt Schottergärten“ NABU: https://sddcdf0fbde817cec.jimcontent.com/download/version/1655197226/module/8294798663/name/Pflanzvorschl%C3%A4ge_Naturgarten.pdf*

Sources: *https://baden-wuerttemberg.nabu.de/umwelt-und-leben/umweltbewusst-leben/naturgarten/index.html*

Insect friendly balcony and container planting

What is it about?

Potted plantings can be enhanced with insect-friendly alternatives to ornamental annuals such as geranium and petunia.

Recommendations for balcony and container planting

Use native perennials instead of annual ornamental flowers. If possible, use plants of regional origin and organic cultivation. (Low) sowings from regional seeds are also suitable.

Many culinary herbs - rosemary, thyme, lavender, savory, sage, oregano, lemon balm, basil and peppermint - are valuable nectar and pollen donors.

Background

Balconies or terraces can be valuable refuges for insects, provided suitable plants are chosen and nesting sites are provided.

Exotic plants and/or plants with double flowers often provide little or no food (pollen and nectar) for insects.

Further recommendations

Domestic perennials are not sensitive to frosts, so the wintering of the plants is not problematic. At temperatures below -5 °C for several days, the tubs should be moved close to the house and, if necessary, protected with old blankets / coconut mats (prevention of frost blasting of the tubs, as well as freezing of the roots). Even in winter, the tubs should be watered from time to time (when the temperature is above zero).

Use peat-free soil. Good potting soil for native wild perennials is easy to mix yourself: half sand, half humus/compost.

Terraces and balconies stocked with pots and tubs can be enriched with nesting aids and/or small watering holes to make this habitat even more insect-friendly.

For further reading: *Species lists for shade and sun balconies: www.nabu.de/umwelt-und-ressourcen/oekologisch-leben/balkon-und-garten/grundlagen/balkon/26158.html*
Species list for potted plants in sunny locations: naturgartenplaner.de/wp-content/uploads/2021/01/wildblumen-fuer-sonnige-toepfe.pdf
Species list for potted plants in shady locations: naturgartenplaner.de/wp-content/uploads/2021/01/wildblumen-fuer-schattige-toepfe.pdf

Sources: *https://naturgartenplaner.de/wildpflanzen-im-topf/*

Early bloomers

What is it about?

Early bloomers create food supply for insects that become active as early as the end of winter and promote diversity in the garden.

Recommendations for gardens

Early bloomers, especially bulbs, can be planted late in the year (until the first frost). Use as wide a variety of different species as possible to ensure the broadest possible flowering spectrum. For insects, wild forms of biological origin are best. When buying, it is best to ask for the botanical names. This is the only way to be sure you are not planting cultivated forms that are less attractive to insects.

Insect-friendly bulbs: winter aconite *(Eranthis hyemalis)*, snowdrop *(Galanthus nivalis)*, sping snowflake *(Leucojum vernum)*, wild crocus *(Crocus vernus, Crocus albiflorus and/or Crocus tommasinianus)*, garden star-of-Bethlehem *(Ornithogalum umbellatum)*, grape hyacinth *(Muscari spec.)*, wild tulip *(Tulipa sylvestris)*, Siberian squill *(Scilla siberica)*.

Other insect-friendly early-flowering perennials: lungwort *(Pulmonaria officinalis)*, anemones *(Anemone nemorosa)*, larkspur *(Corydalis cava)*, basket of gold *(Alyssum saxatile)*, rockcress *(Arabis spec.)*, lilacbush *(Aubrieta deltoidea)*, evergreen candytuft *(Iberis sempervirens)*.

Hintergrund

Different insect species have different flight times throughout the day and year. Therefore, you should encourage a wide range of blooms throughout the year to provide food for different insects at their respective flight times.

Hibernating queen bumblebees, for example, fly from +2 °C to forage for food. Many other wild bee species already hatch in March, which is why early flowering plants are important for their survival.

There are also species of wild bees that depend on certain plant species, such as the milkweed sand bee on the umbelliferous milkweed.

Further recommendations

Autumn is also a particularly suitable time for planting (wild) perennials, native shrubs and trees.

Early flowering trees and shrubs such as willow, blackthorn, cornelian cherry or hazel also provide a good food source for insects.

For further reading: https://wildermeter.de/tipp-insektenfreundliche-fruehblueher/

Sources: https://www.wildbienen.info/artenschutz/nahrungsangebot_06.php

Maintenance work in autumn

What is it about?

Fall maintenance activities should consider overwintering habitats for insects.

Recommendations for (parts of) gardens

Leave portions of „old"/faded vegetation to provide overwintering habitat. Faded stems should be retained until May of the year after next. Alternatively, stems can be „stored" leaning upright or tied down in a less prominent/exposed location. If you discover pithy stems with boreholes, leave them in place throughout the summer as well. It is likely that special wild bees have taken up residence here.

Maintain old grass strips and/or „wild corners" during the last cut and do not cut them again until June of the following year.

Leave a litter pad and/or place leaf piles in a targeted manner.

Do not cut back the entire hedge/woody structure at one time. Leave at least 1/3 of the structure until the next cut. Next winter, select another section of the hedge.

Background

Insects have very complex life cycles: many overwinter as eggs/pupae/caterpillars in cavities, (tall!) grass stands, vegetation-covered ground, or open sandy soils. Some also overwinter as adult insects. Therefore, dry and withered plant parts should be preserved at least partially and, if possible, permanently and at least through the winter.

Further recommendations

Autumn is also a particularly suitable planting time for (wild) perennials, native shrubs and trees. Early bloomers should also be planted before frost (see „Early bloomers" measure sheet).

Improve the soil of the vegetable patch with diverse green manure and encourage insects at the same time. For this purpose, it is ideal if the green manure is sown in early autumn and remains as long as possible through the spring.

Do not forget about other animals in the garden: shelter for hedgehogs, quarters for amphibians and reptiles, winter birds...

For further reading: https://www.nabu.de/umwelt-und-ressourcen/oekologisch-leben/balkon-und-garten/tiere/insekten/25090.html

Sources: https://www.nabu.de/umwelt-und-ressourcen/oekologisch-leben/balkon-und-garten/pflege/saisonal/herbst/23139.html

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Boosting biodiversity:
Measures for more insect diversity in agriculture, municipalities and gardens

insect-responsible.org