Exploit biodiversity in viticultural systems to reduce pest damage and pesticide use, and increase ecosystems services provision

BIOVINE

WP 2 Plant species suitable to control arthropod pests in the vineyard

Patrik Kehrli

Agroscope, KIS & SCV

Schweizerische Eidgenossenschaft
Confédération suisse
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Swiss Confederation

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S.C.D.V.S. MURFATLAR

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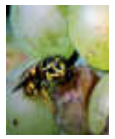
Viticultural pests



Viticultural pests

main focus within Biovine





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Plants against viticultural pests

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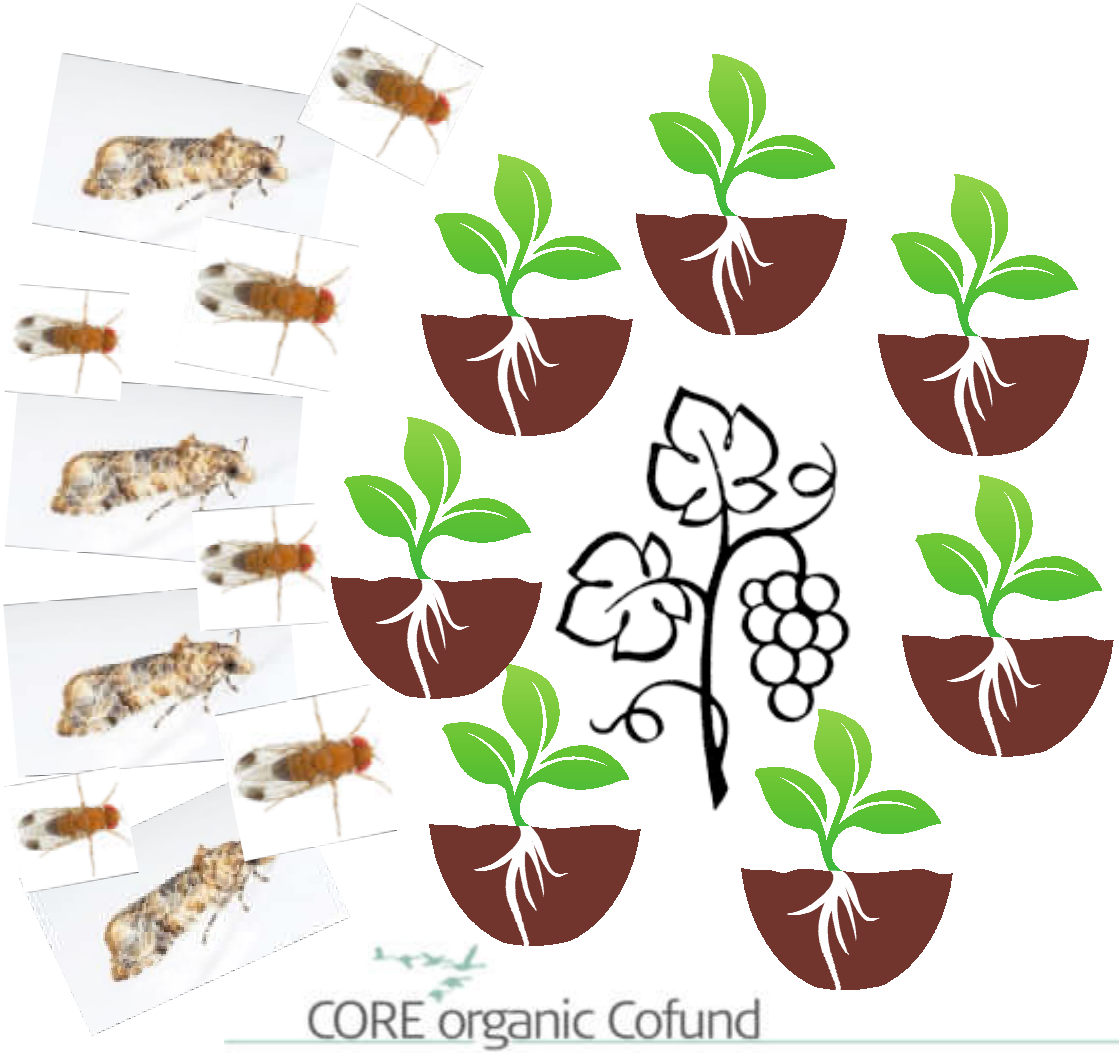
Plants against viticultural pests



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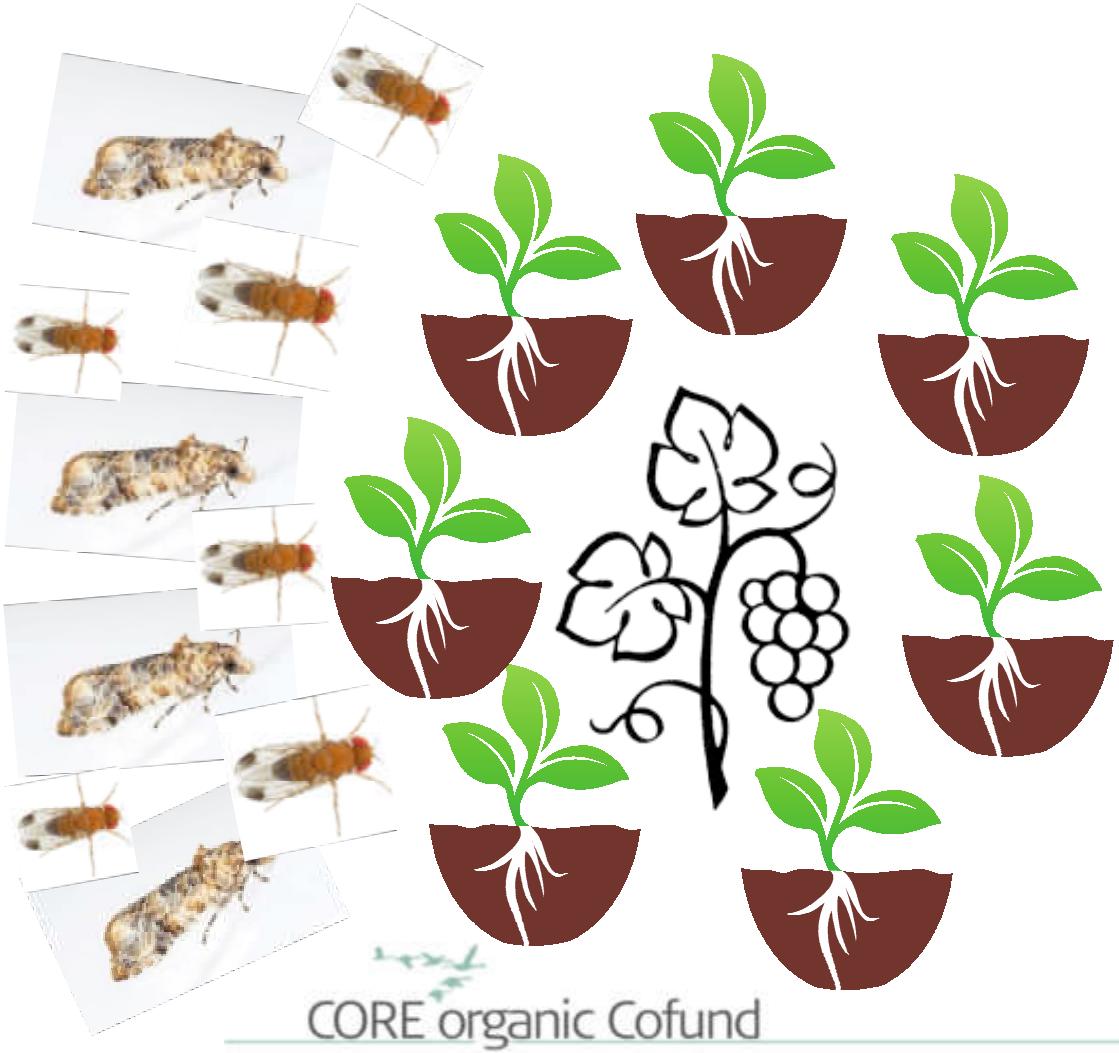
Plants against viticultural pests



1. Repel pests away from crop
2. Attract pests away from crop

Viticultural beneficials









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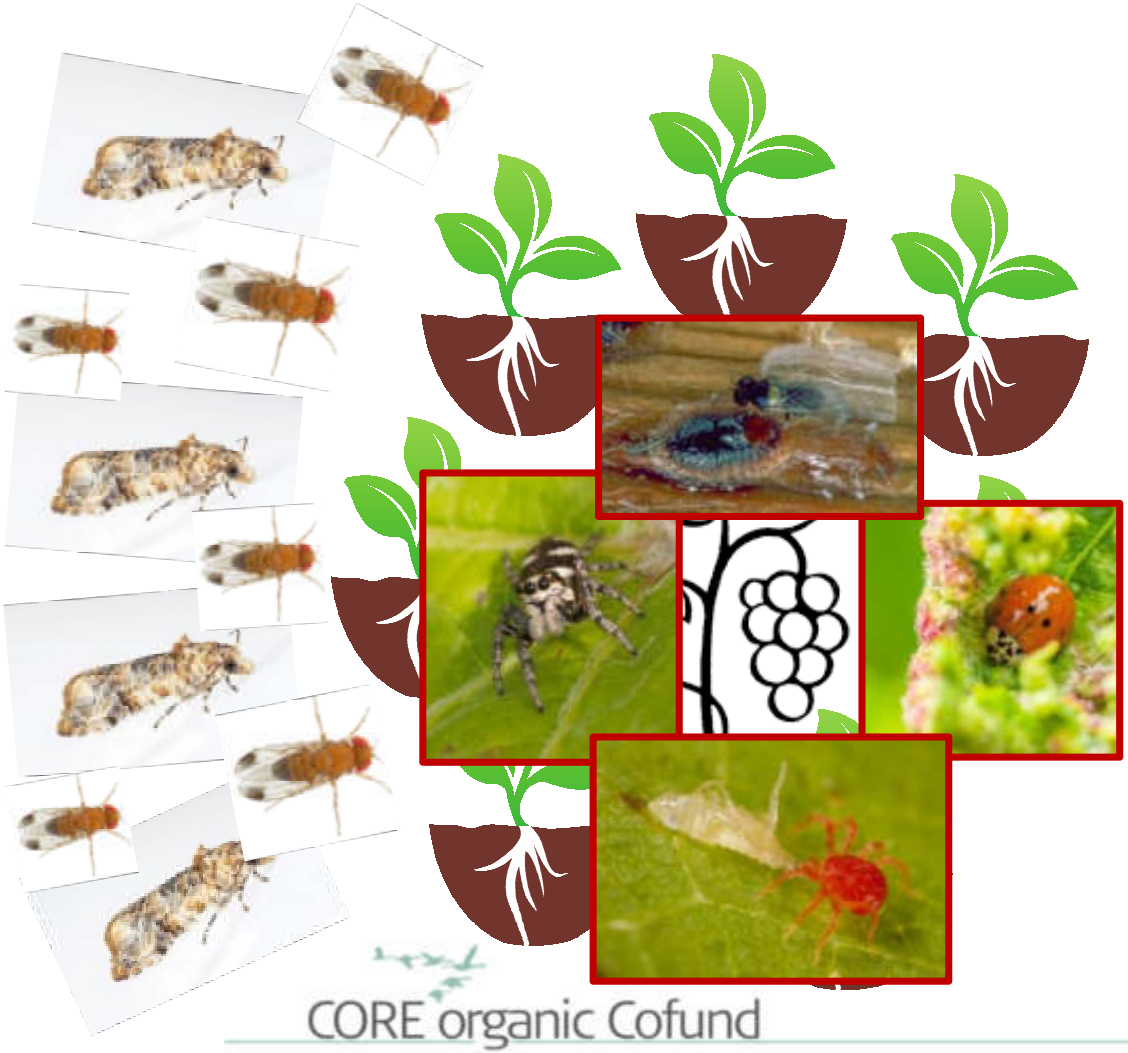
Plants against viticultural pests



1. Repel pests away from crop
2. Attract pests away from crop
3. **Conserve and promote beneficials that regulate pests**





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WP 2 Control of arthropod pests

Objective 1: **Plant species to repel *Lobesia botrana***

Objective 2: **Trap crops to attract *Drosophila suzukii***

Objective 3: **Plant species to promote beneficials**

WP 2 Control of arthropod pests

Plant species to repel *Lobesia botrana*

Aurora Ranca

Anamaria Petrescu

S.C.D.V.N. MURFATLAR

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Confédération suisse
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Anne-Laure Fragnière

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Plant species to repel *Lobesia botrana*

Based on a literature review of ~40 scientific papers by SCV

Plant species	*Artemisia absinthium*	*Armoracia rusticana*	*Lavandula angustifolia*	*Allium sativum*	*Tagetes* sp.	*Tanacetum cinerariifolium*
						

were selected to be tested on their repellence against *L. botrana*.

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Plant species to repel *Lobesia botrana*

Based on a literature review of ~40 scientific papers by SCV

Wormwood (*Artemisia absinthium*) - fermented extract 100 grams dried plan in one liter of rainwater.	repellent
Horseradish (*Armoracia rusticana*) infusion 30 grams per liter of water	repellent
Tagetes (*Tagetes* sp.) infusion 250 grams dried plant in one liter of rainwater.	Insecticide, nematicid
Piretrum (*Tanacetum cinerariifolium*) infusion 100 grams dried plan in one liter of rainwater	Insecticide, repellent
Lavender (*Lavandula angustifolia*) infusion 100 grams dried plan in one liter of rainwater	repellent
Garlic (*Allium sativum*) macerated 12 hours in 3 tablespoons of linseed oil - in one liter of rainwater	repellent, nematicid

were selected to be tested on their repellence against *L. botrana*.

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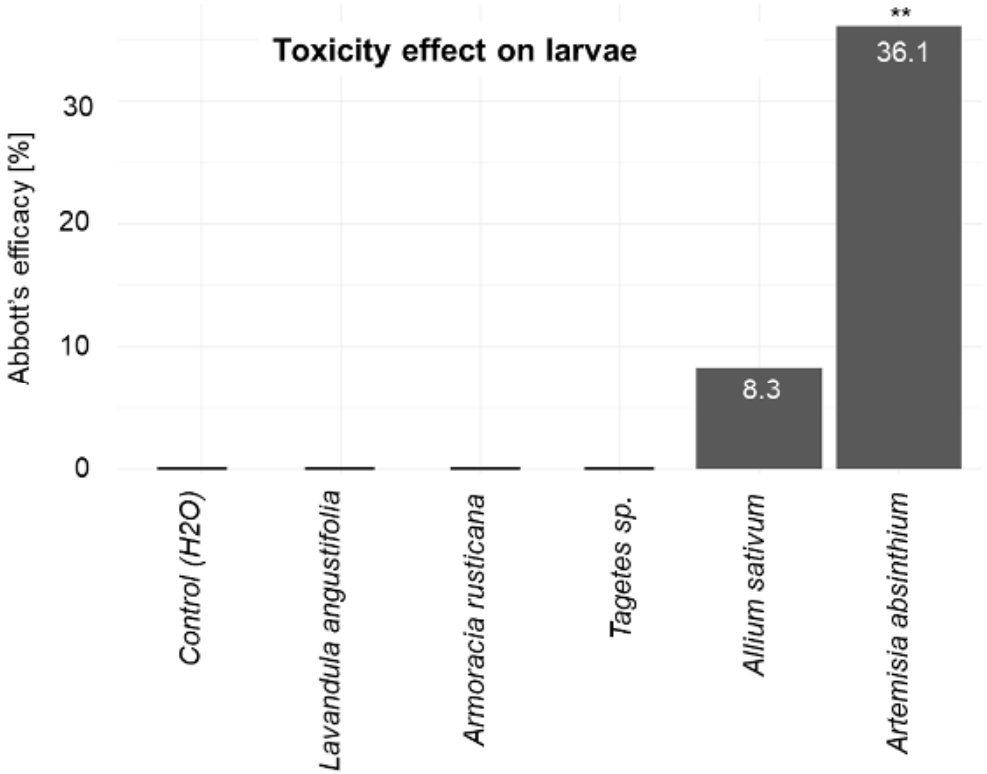
Plant species to repel *Lobesia botrana*



→ **Toxicity to weak to directly kill larvae under field conditions**

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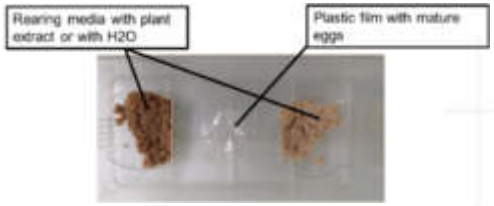
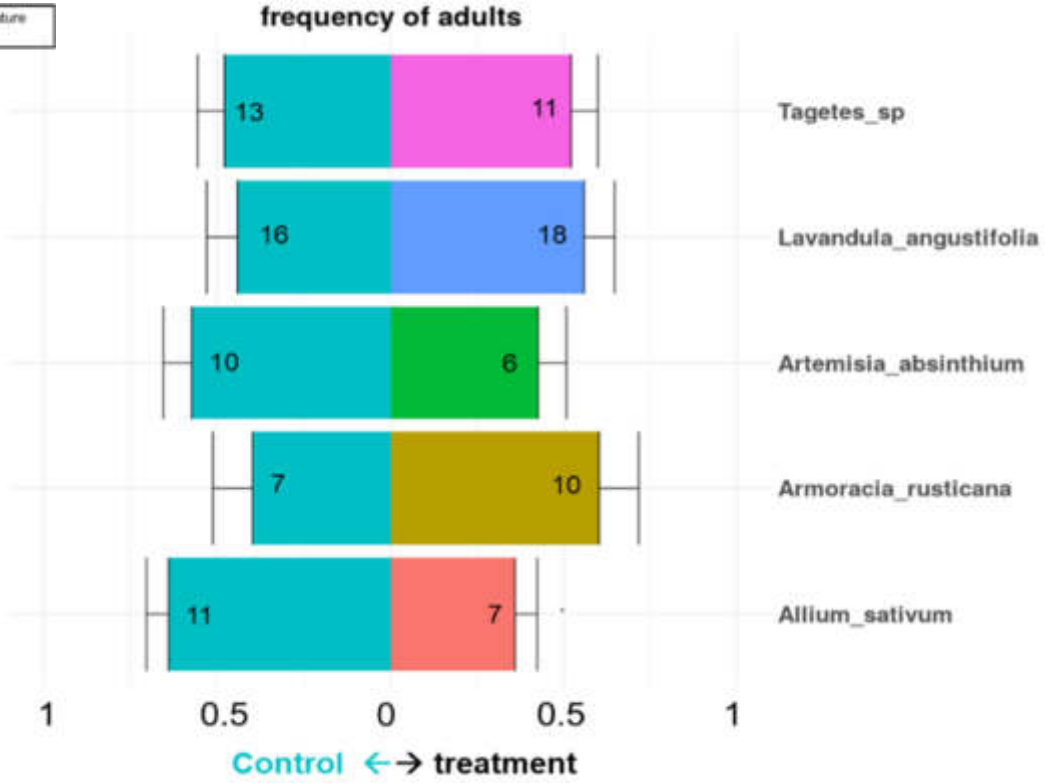
Plant species to repel *Lobesia botrana*





→ **Larvae are not directly repelled by plant extracts**

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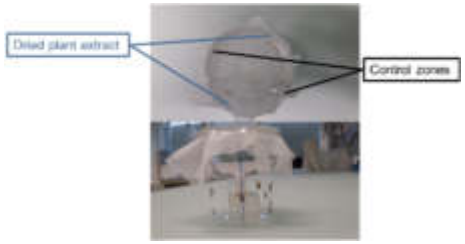
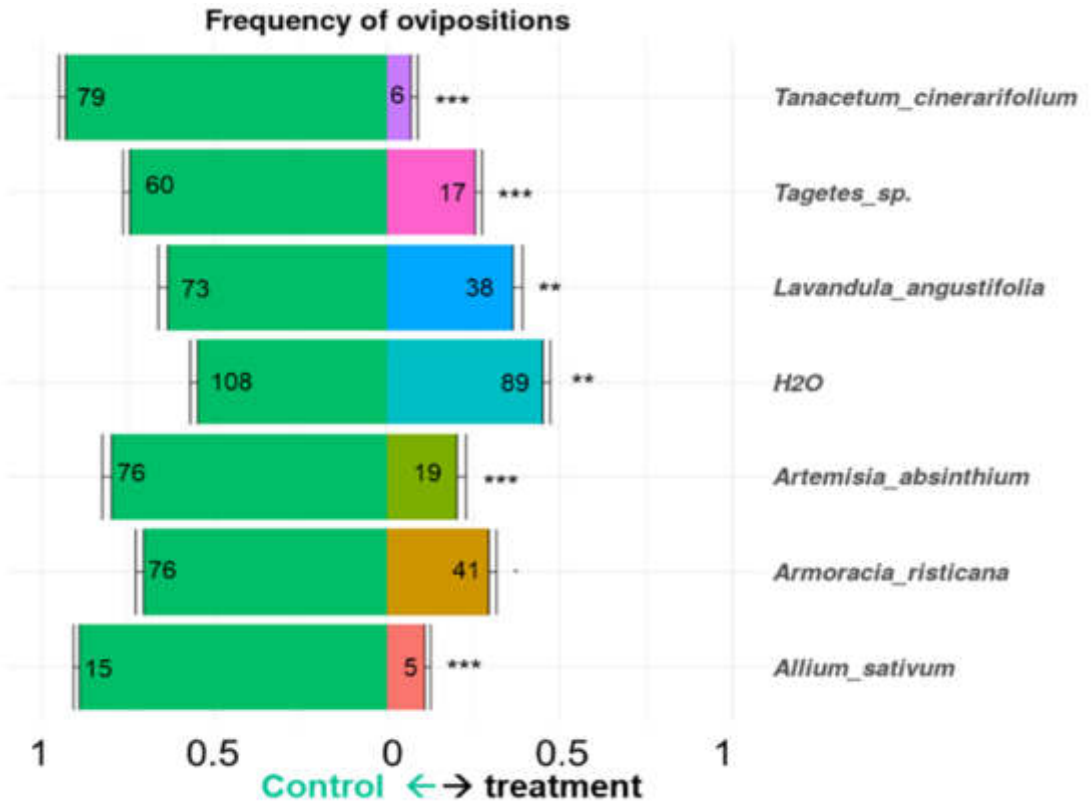
Plant species to repel *Lobesia botrana*





→ **Several plant species repelled females from egg laying**

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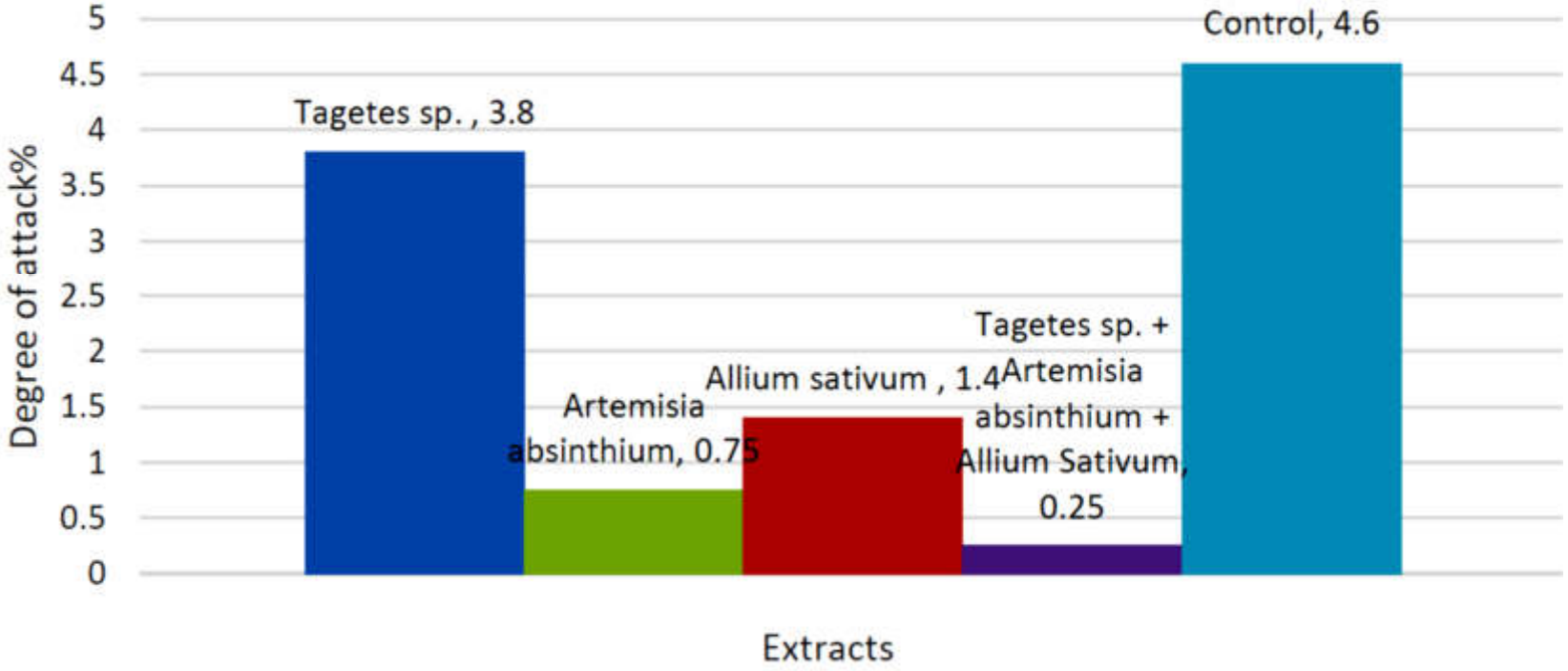
Plant species to repel *Lobesia botrana*

Extracts of horseradish (*Armoracia rusticana*), tagetes (*Tagetes sp*.) and garlic (*Allium sativum*) were tested in experimental vineyard of SCV at BBCH 83-85.

Plant species to repel *Lobesia botrana*



→ **Further field tests needed to confirm efficacy**

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WP 2 Control of arthropod pests

Trap crops to attract *Drosophila suzukii*

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Anne-Laure Fragnière

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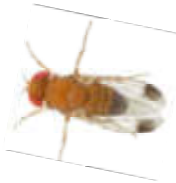
Trap crops against *Drosophila suzukii*



Grape maturation

1. Timing
2. High attractiveness for oviposition
3. Low development success

1. Study of attractivity and development success of *D. suzukii* on different plant species,
2. Identifying promising trap crop species and test of potential candidates under semi-field and field conditions.

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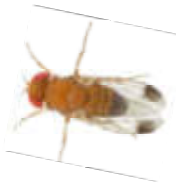
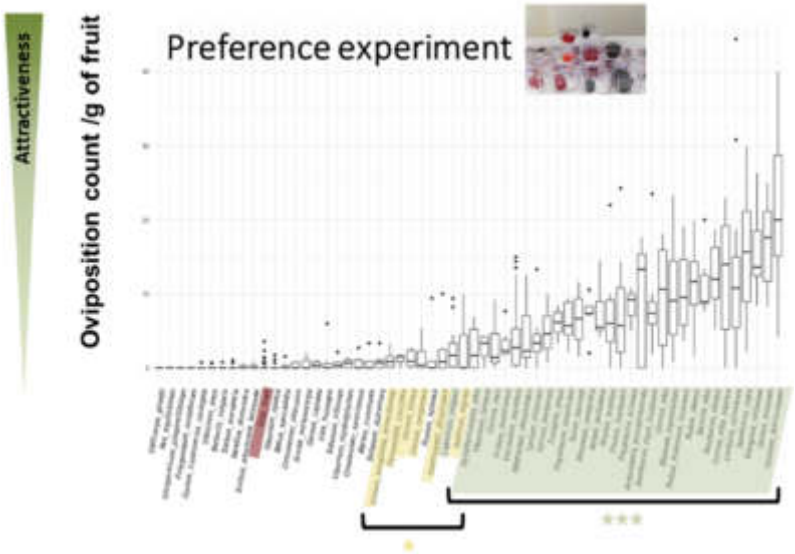
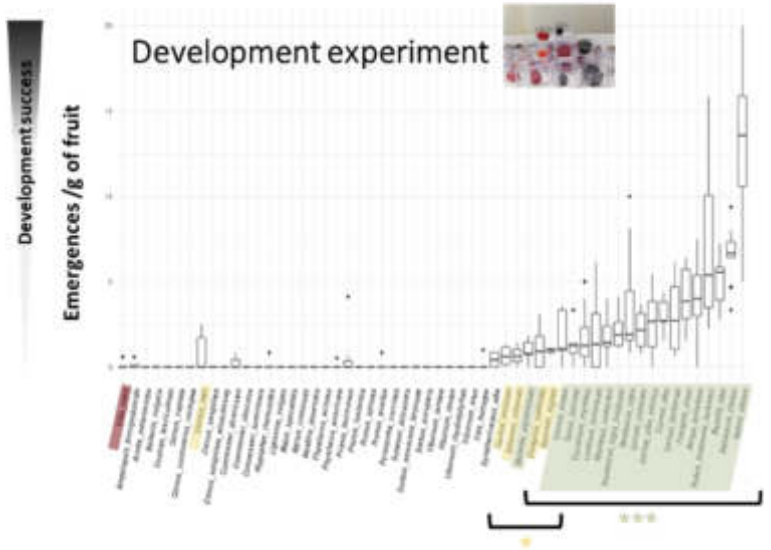
Trap crops against *Drosophila suzukii*



Identification of 229 different host plant species in the literature, from which 61 species were selected to be tested.





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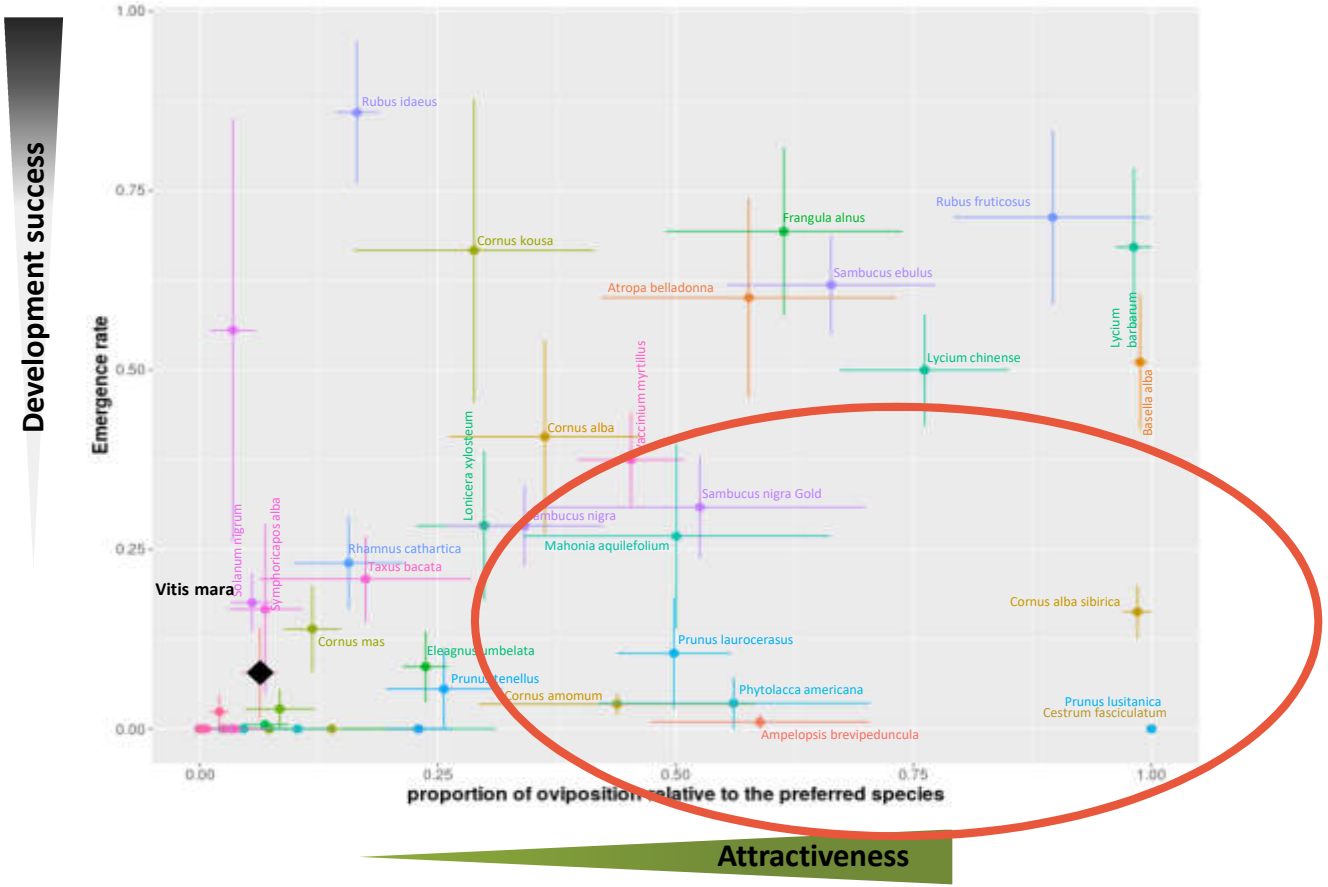
Trap crops against *Drosophila suzukii*



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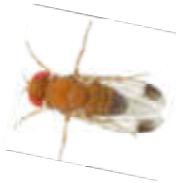
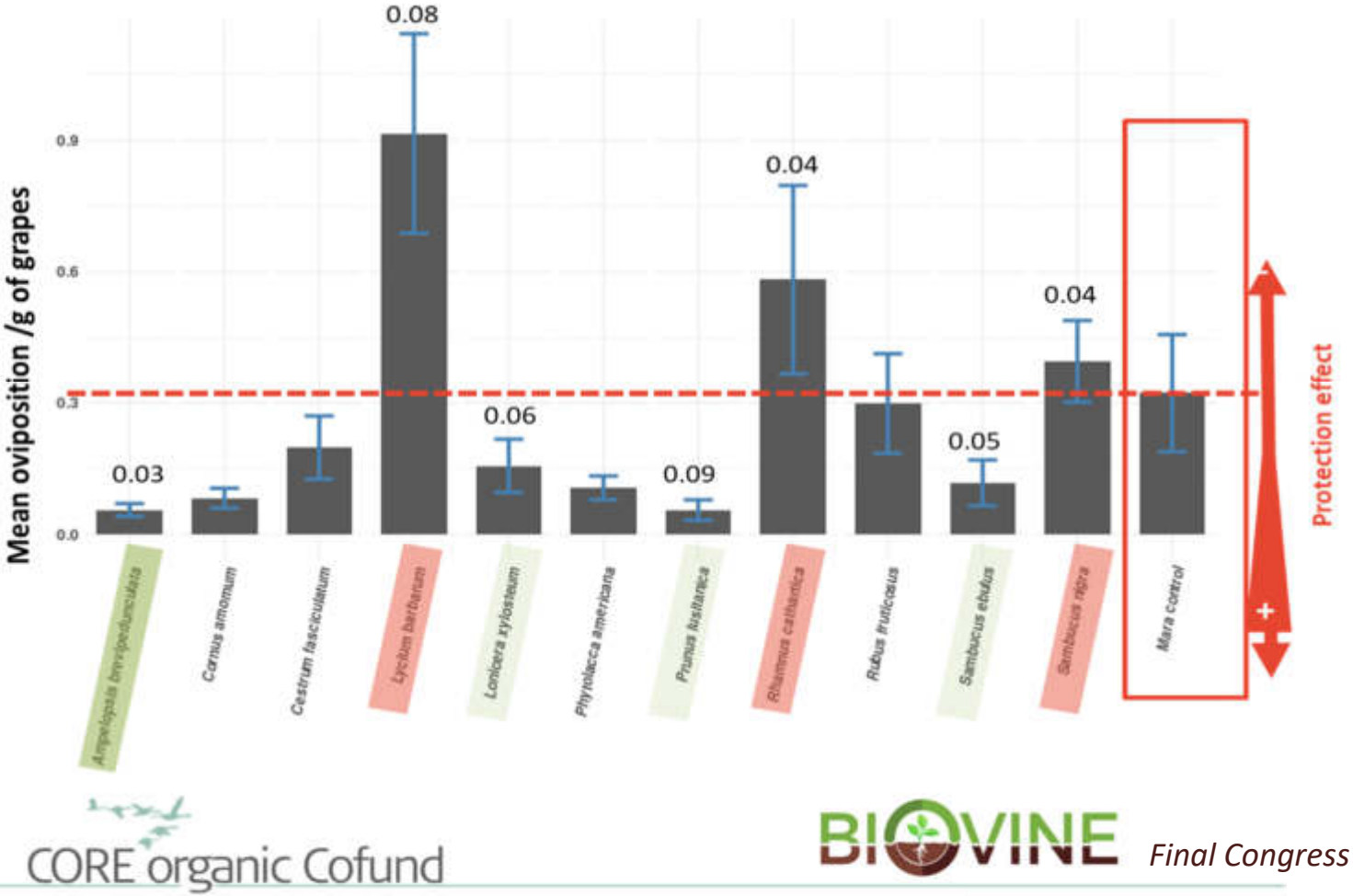
Trap crops against *Drosophila suzukii*



Semi-field tests of 11 potential trap crops



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Trap crops against *Drosophila suzukii*

	Lonicera xylosteum	*Cornus amomum*	*Cestrum fasciculatum*	*Sambucus ebulus*	*Sambucus nigra*	*Rhamnus cathartica*	*Rubus fruticosus*	*Lycium barbarum*	*Prunus lusitanica*	*Ampelopsis brevipedunculata*	*Phytolacca americana*
Low emergence (lab)	×	✓	✓	✓	✓	✓	×	×	✓	✓	✓
Attractiveness (lab)	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓
Attractiveness (cage)	✓	(✓)	(✓)	✓	✓	✓	✓	✓	✓	✓	(✓)
Attractiveness (outdoor)	×					×	✓	×			
Protection effect (lab)	✓	=	=	✓	=	(×)	✓	=	(✓)	✓	✓
Protection effect (cage)	(✓)	=	=	(✓)	×	×	=	(×)	(✓)	✓	=
Protection effect (outdoor)	×					×	×	×			

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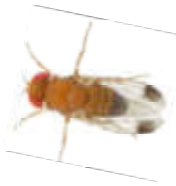
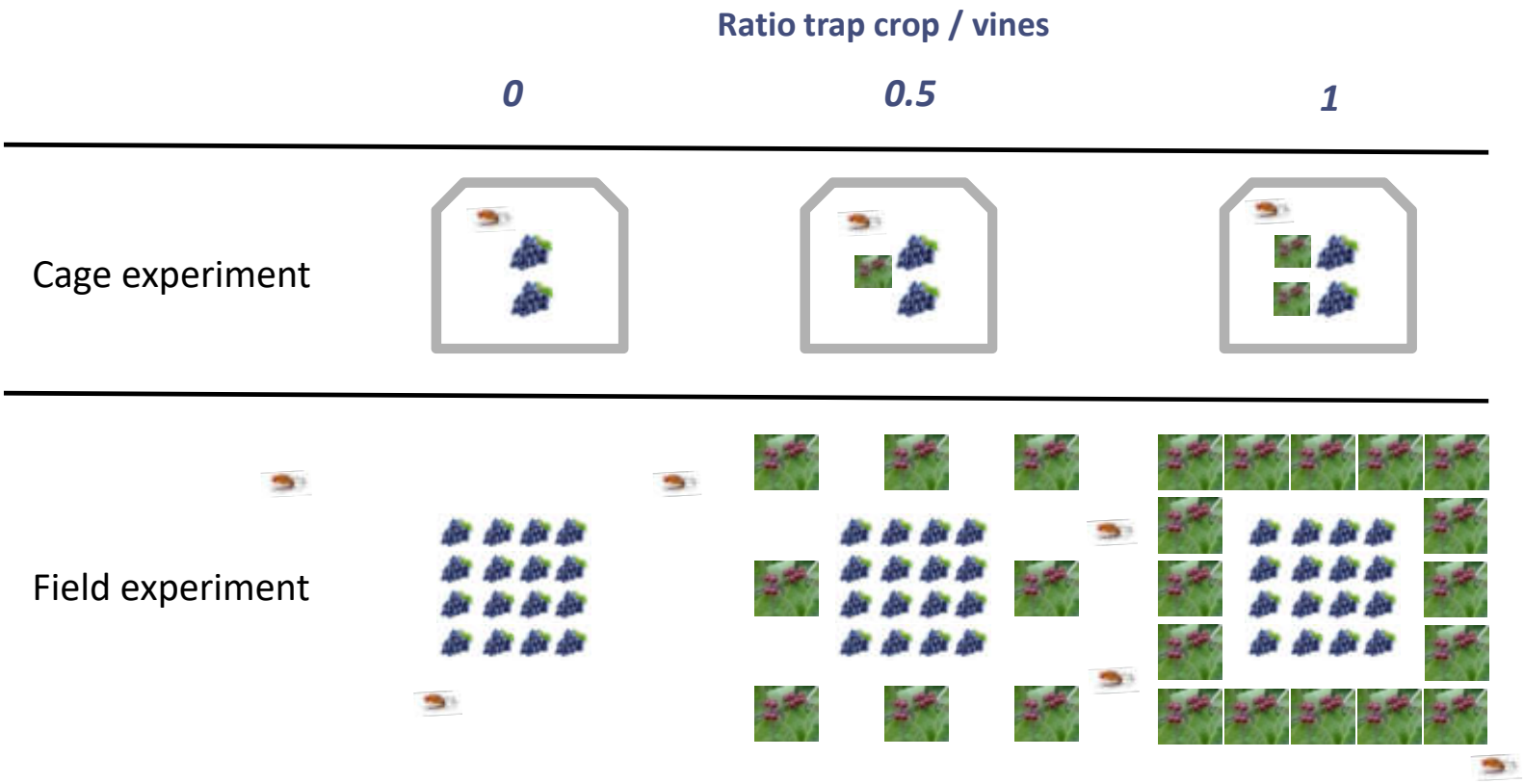
Trap crops against *Drosophila suzukii*



Semi-field and field tests with *Lonicera xylosteum* as trap plant



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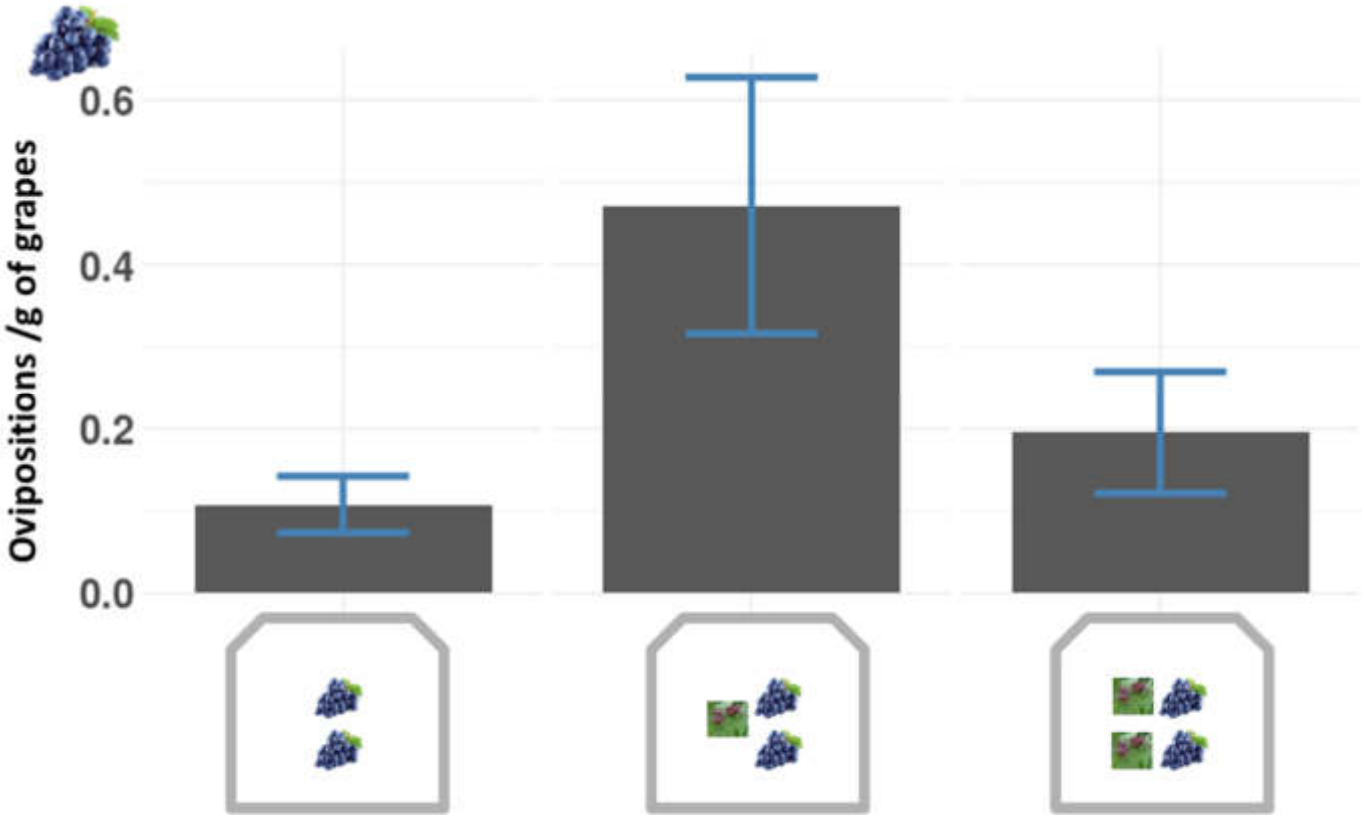
Trap crops against *Drosophila suzukii*



→ **No protection of grapes**

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Trap crops against *Drosophila suzukii*

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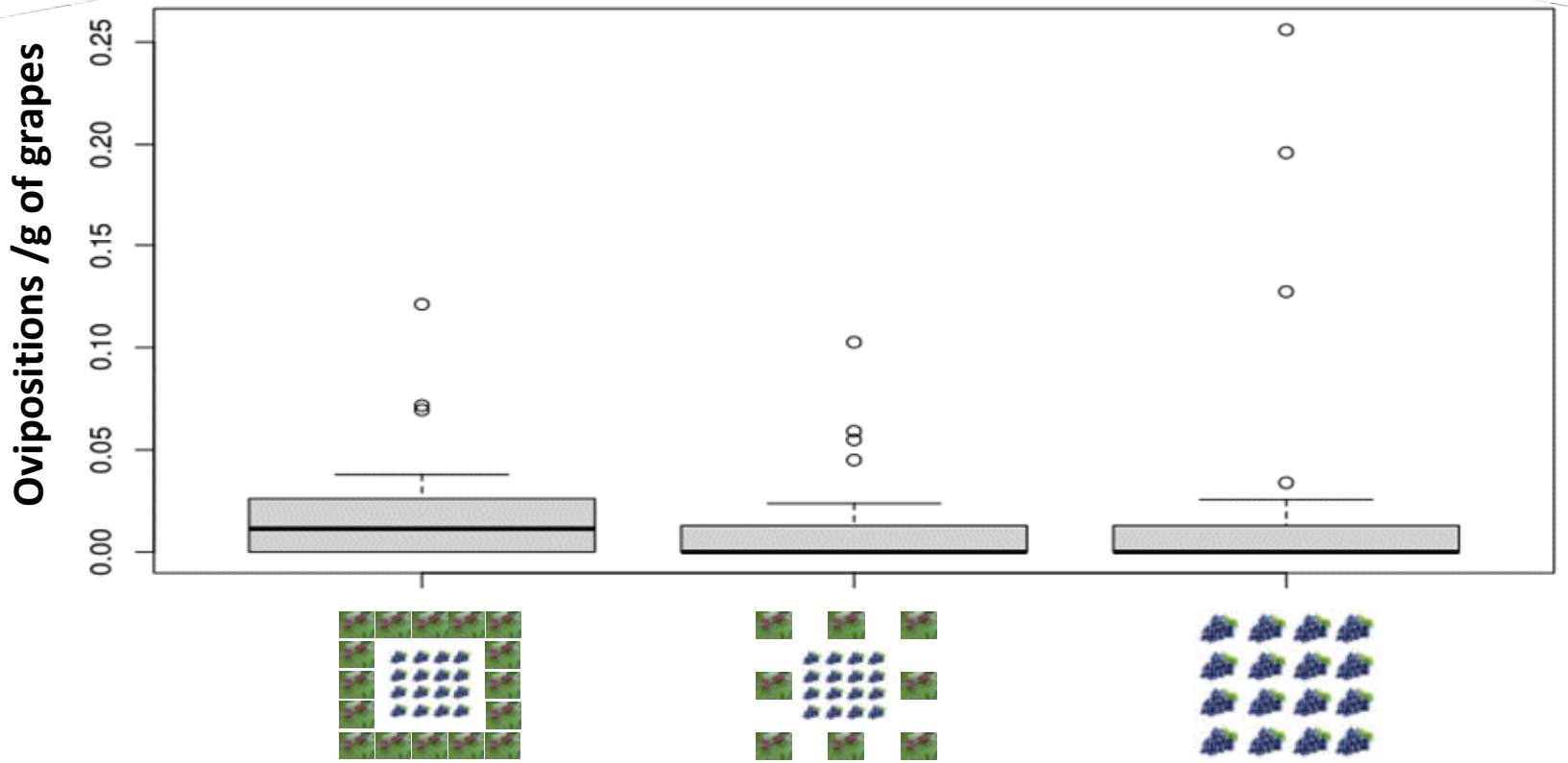
BIOVINE *Final Congress*

Trap crops against *Drosophila suzukii*



→ **No protection of grapes**

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WP 2 Control of arthropod pests

Plant species to promote beneficials

Jaka Razinger

Agricultural Institute of Slovenia

Primož Žigon

Špela Modic

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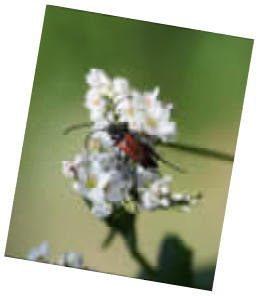
Promotion of beneficials

Based upon a literature survey the species rich cover crop mix Artenreiche Spezial-Dauerbegrünung (Biohelp, Austria) was tested

Vrsta	Common name	Family	%	Beneficial organisms
Vicia pannonica	Pannonian vetch	Fabaceae	12%	ichneumonid wasps
Festuca ovina	sheep/hard fescue	Poaceae	11%	
Onobrychis spp.	sainfoin	Fabaceae e	10%	
Fagopyrum esculentum	buckwheat	Polygonaceae	9%	parasitic wasps; ladybugs; tachinid and hover flies; and lacewings; pollinators; minute pirate bug Orius
Trifolium incarnatum L.	berseem clover / crimson clover	Fabaceae	7%	Hoverflies (Diptera: Syrphidae): Meliscaeva cinctella; Parasitic wasps, big-eyed bugs-Geocoridae, minute pirate bugs-Anthocoridae ; ladybugs; tachinid flies and aphid midges
Pisum sativum	pea peas; field pea	Fabaceae	6%	
Carum carvi	caraway	Apiaceae	6%	
Phacelia sp.	Phacelia	Boraginaceae	5%	Hoverflies (Diptera: Syrphidae): Eupoedes lapponicus, Scaeva pyrastri, Syrphus opinator, Toxomerus marginatus
Calendula officinalis	marigold	Asteraceae	5%	Hoverflies (Diptera: Syrphidae): Sphaerophoria sulphuripes
Sinapis alba or Brasica hirta or B. alba	yellow / white mustard	Brassicaceae	5%	Hoverflies (Diptera: Syrphidae): Sphaerophoria sulphuripes
Trifolium alexandrinum	Alexandrine clover	Fabaceae	5%	bigeyed bug, G. punctipes
Matricaria inodora		Asteraceae	5%	
Daucus carota		Apiaceae	3%	nectarivorous parasitic wasps minute pirate bug Orius
Malva verticillata		Malvaceae	3%	
Lotus corniculatus	birdsfoot trefoil	Fabaceae	2%	
Trifolium pratense		Fabaceae	2%	
Melilotus albus	Bokhara clover	Fabaceae	2%	
Camelina sp.		Brassicaceae	1%	
Achillea millefolium	yarrow	Asteraceae	1%	Hoverflies (Diptera: Syrphidae): Meliscaeva cinctell, Paragus variables, Sphaerophoria sulphuripes, Syrphus opinator, Toxomerus occidentalis

It contains many target plant species that conserve and promote beneficials



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Promotion of beneficials

Traditional

Cover crop

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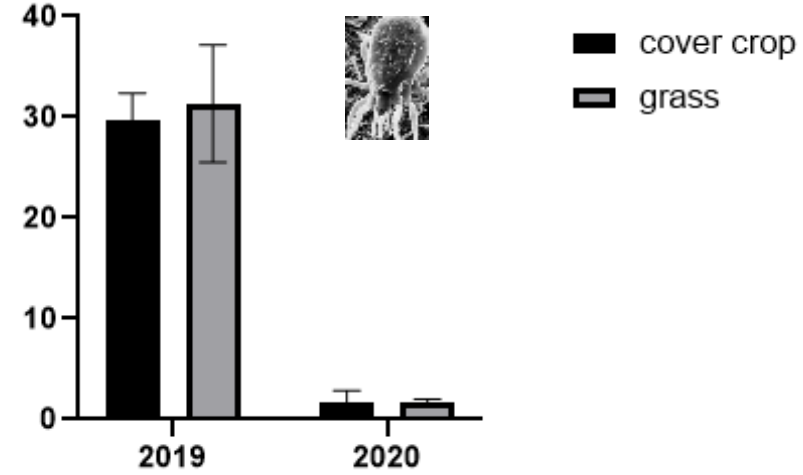
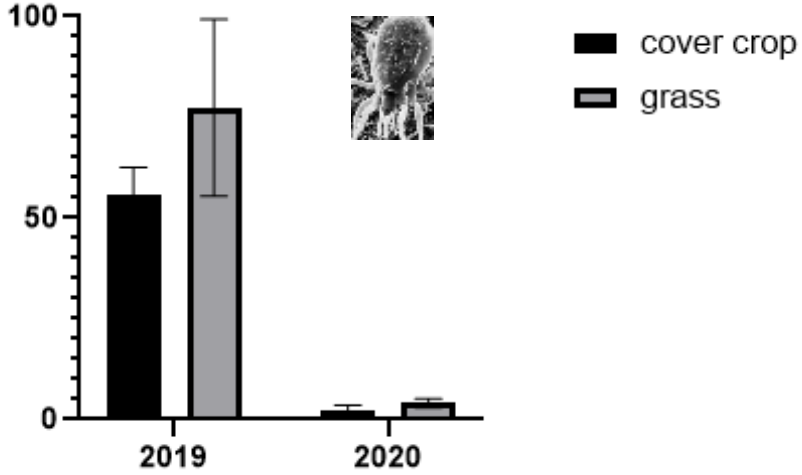
Promotion of beneficials

Average no. of leaves with predatory mites per 50 leaves

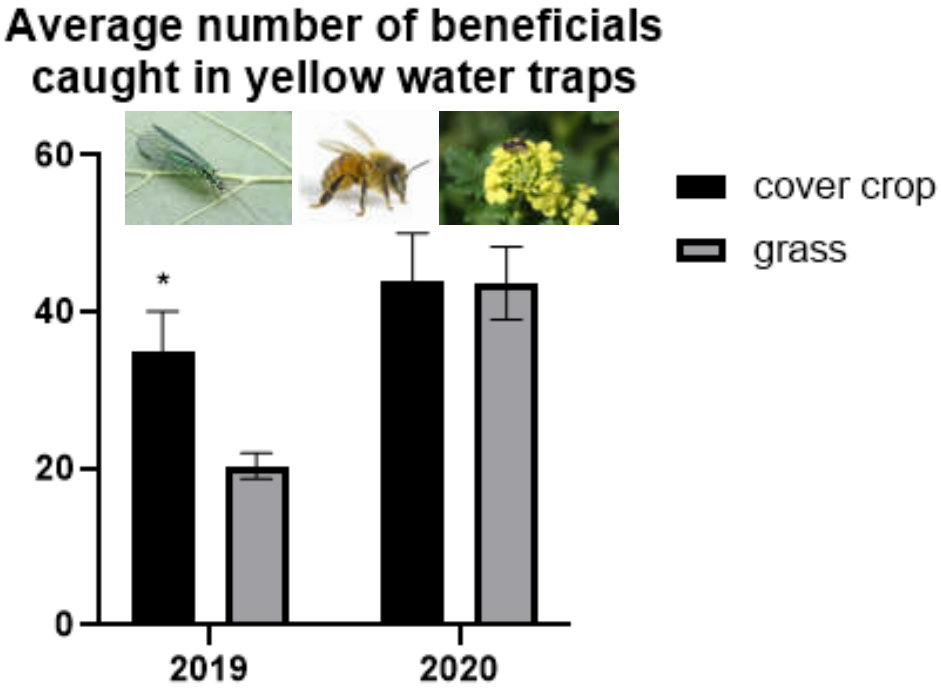


Average no. of predatory mites per 50 leaves



→ No observation of a significant increase or decrease of predatory mites in the plot with cover crops.

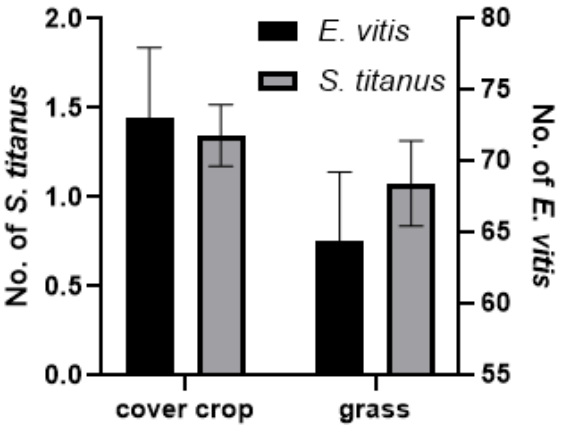
Promotion of beneficials



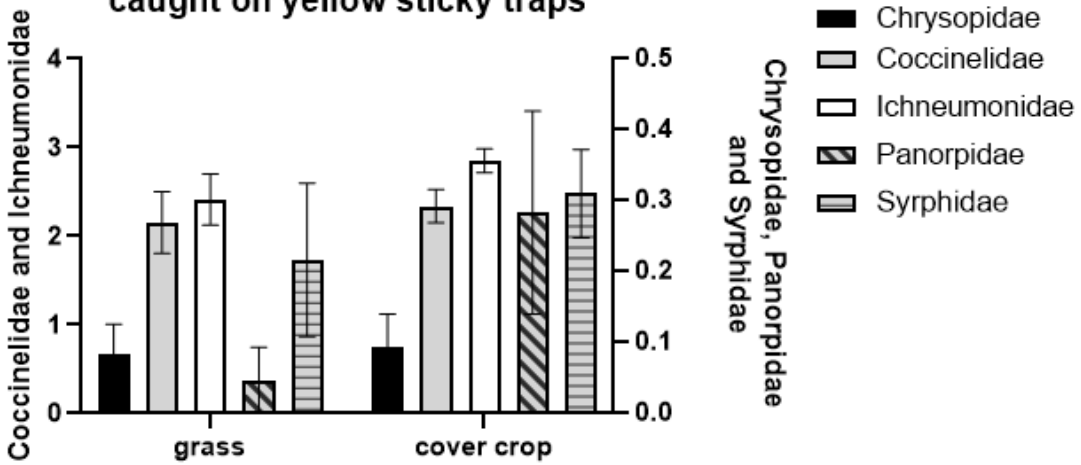
→ Observation of a significant increase of beneficials in the plot with cover crops in 2019.

Promotion of beneficials

Average number of pests caught on yellow sticky traps

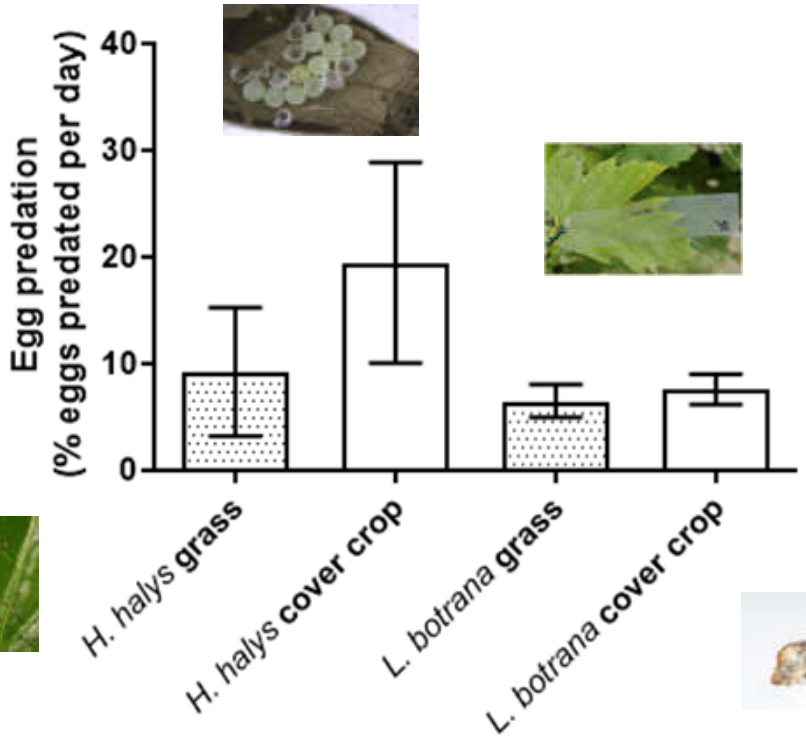


Average number of beneficials caught on yellow sticky traps



→ No observation of a significant increase or decrease of pests and beneficials in the plot with cover crops.

Promotion of beneficials



→ No observation of a significant increase in egg predation in the plot with cover crops.

WP 2 Control of arthropod pests

Conclusion

Plant species to repel *Lobesia botrana*

Trap crops to attract *Drosophila suzukii*

Plant species to promote beneficials

Communications

CORE Organic Cofund > News and events > show

Can cover crops reduce arthropod pests in vineyards?

To control arthropod pests, cover crops can either directly repel harmful species or indirectly favour beneficials. In the CORE Organic Cofund project BIOVINE plant species are tested for their capacity to reduce the impact of arthropod pests.

2020.04.28 | CHRISTINE DILLING

Sown cover crops within a Slovenian vineyards

The capacity of plant diversity to increase the resistance of crops towards pests and invasive species is well-known. However, monocultures such as vineyards do not fully exploit the potential of plant diversity. BIOVINE aims to develop new viticultural systems based on increased plant diversity within (e.g., cover crops) or around (e.g., hedges, vegetation strips, edgings) vineyards by planting selected plant species for the control of arthropod pests, soil-borne diseases and foliar pathogens. To control arthropod pests, plants species can either i) repel arthropod pests or ii) conserve and promote beneficials. An extensive systematic literature search was performed to identify plant species suitable for repelling the grapevine moth (*Lobesia botrana*) and for conserving and promoting beneficials.

i) Repel grapevine moth: *Allium sativum*, *Armoracia rusticana*, *Artemisia absinthium*, *Lavandula angustifolia*, *Tagetes* sp. and *Tanacetum vulgare*/*balsamita* were identified as potential candidates to repel *L. botrana* from grapes. Extracts of these plant species were prepared and tested in the laboratory. The tested extracts had neither a strong effect on the survival of *L. botrana* larvae, nor did they repel larvae from feeding. However, nearly all extracts repelled females from egg laying (Fig. 1). Thus, the extracts from *Allium sativum*, *Artemisia absinthium* and *Tagetes* sp. were retrieved and tested against *L. botrana* under field conditions. *Lobesia botrana* infestation was lowest on grapes protected by a mixture of these three extracts. Thus, this mixture of extracts might have potential to protect vines against grapevine moths.

ii) Attract and conserve beneficials: Many beneficials such as predatory mites, spiders, carabids, ladybirds, lacewings, hoverflies and parasitoids feed on pollen and nectar. Their activity can therefore be increased by the provision of

BioVine – Practice Abstract

CORE organic

Conserve and enhance beneficials in organic vineyards

Problem

Bare vineyards are hostile environments for many beneficials since predators (e.g. predatory mites, spiders, carabids, ladybirds, hoverflies), parasitoids as well as pollinators rely on cover crops for the provided shelter and food on their floral nectar and pollen.

Solution

Beneficials' activity can be increased by the provision of nectar- and pollen rich plant species, such as plants from the families of Apiaceae, Asteraceae, Caryophyllaceae and Fabaceae.

Impact

Field trials in several European vineyards confirmed that sown cover crops (Picture 1) favoured the abundance of arthropods and predators. In particular, predatory beetles were more abundant in vegetated vineyards than in vineyards of bare soil.

Practical recommendations

- **Sow cover crops or allow spontaneous vegetation to develop. These measures do not only reduce soil erosion, conserve soil moisture, maintain organic soil matter and retain and recycle plant nutrients, but they also increase plant diversity and thereby provide habitats and food for beneficials and boost biodiversity.**
- **Select nectar- and pollen-rich plant species that are adapted to the region and do not interfere with the growth of grapevines (water and nutrient competition).**
- **Sow the selected cover crops at the opportune moment over the year (often autumn) in prospect of favorable weather conditions in order that sown seeds can germinate.**
- **Limit the cutting and mulching of the flowering vegetation in order that the provided nectar and pollen is at the disposal of beneficials such as pollinators, parasitoids and predators and that cover crop species can reproduce.**
- **Adapt phytosanitary measures and reduce mechanical passages in order to protect and conserve the beneficial fauna.**

Applicability box

Theme
Cover cropping, spontaneous vegetation

Geographical coverage
Vineyards in European/Mediterranean area

Application time
Autumn/spring sowing

Period of impact
Continuous (including sowing and mulching periodically)

Equipment
Basic sowing method

USING COVER CROPS TO CONTROL LOBESIA BOTRANA IN ORGANIC VINEYARDS

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