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UNIVERSITÀ CATTOLICA del Sacro Cuore
DIPROVES
Sustainable Crop Protection Area

Introduction

- BIOVINE project is developing natural solutions to reduce pesticide dependence.

- The aim of the project is to develop new viticultural system based on increased plant diversity (e.g. cover crops) within and/or around (e.g. hedges, endings) vineyards by planting selected species to control:
  - Arthropods
  - Soil-borne pests (e.g.fungi, nematodes)
  - Foliar pathogens

- BIOVINE is multi-partner project and structured into 7 different Work Packages (WP). Each work package is led by a component partner, which involves 6 countries (Italy, France, Romania, Spain, Slovenia and Switzerland).

Objectives

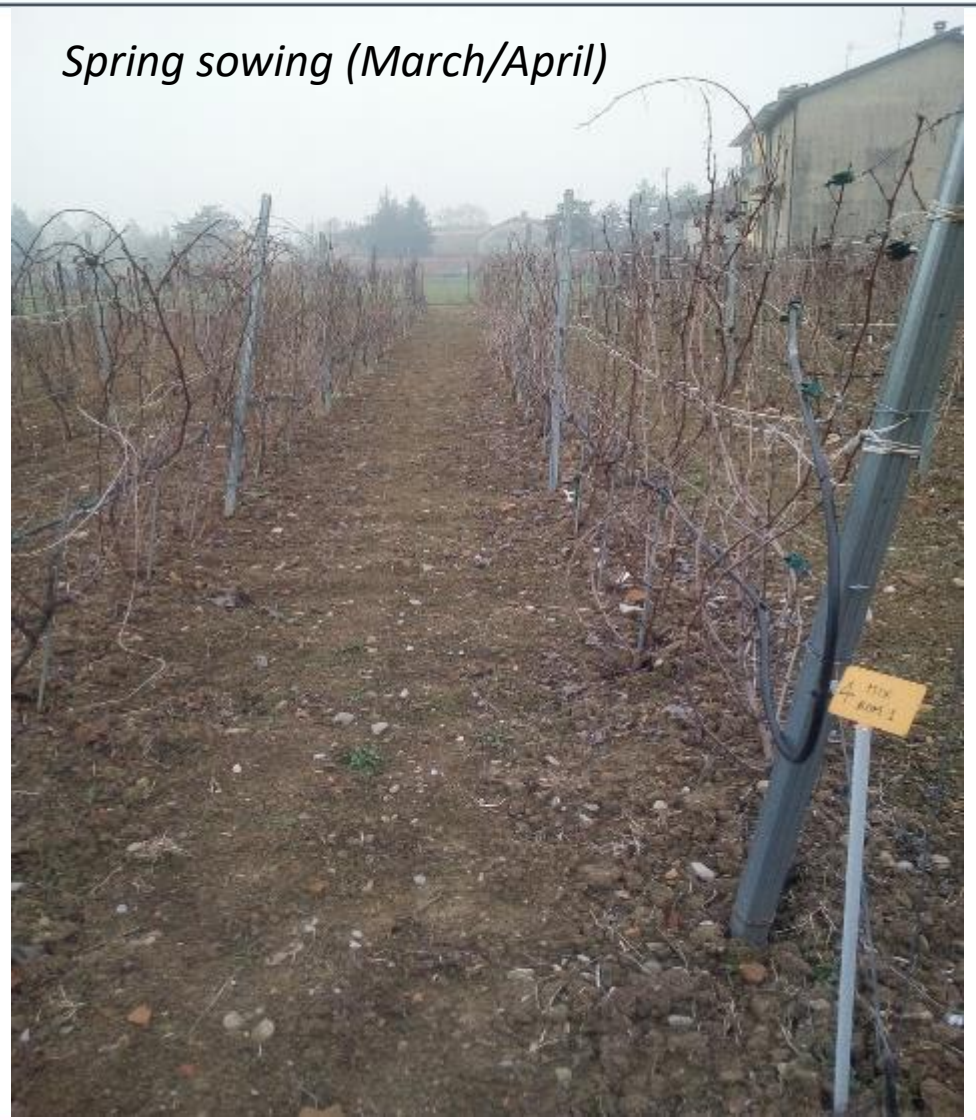
- Control of pest populations (any organism harmful to crops including oomycetes, fungi, bacteria, nematodes and harmful arthropods)
- Reduction of pest damages
- Reduction of pesticide use
- Increase of the ecosystem services provided

Project activities

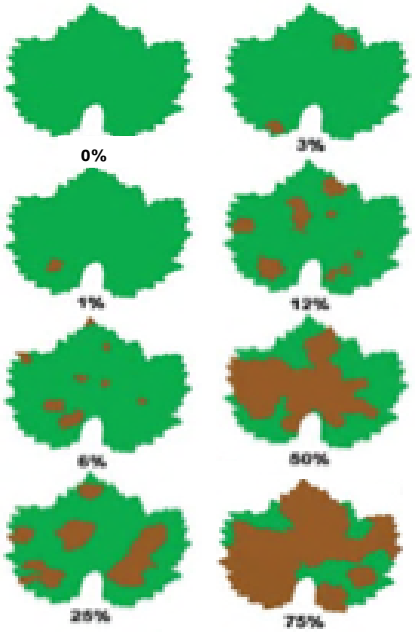
- Identify and select candidate plants
- Test plants in controlled conditions or small-scale environments for their ability to control soil-borne pests (oomycetes, fungi, nematodes) and foliar pathogens
- Design new viticultural systems able to exploit plant biodiversity in organic vineyard
- Test the new viticultural systems (on-farm) in several locations in Italy, in comparison to the current practice

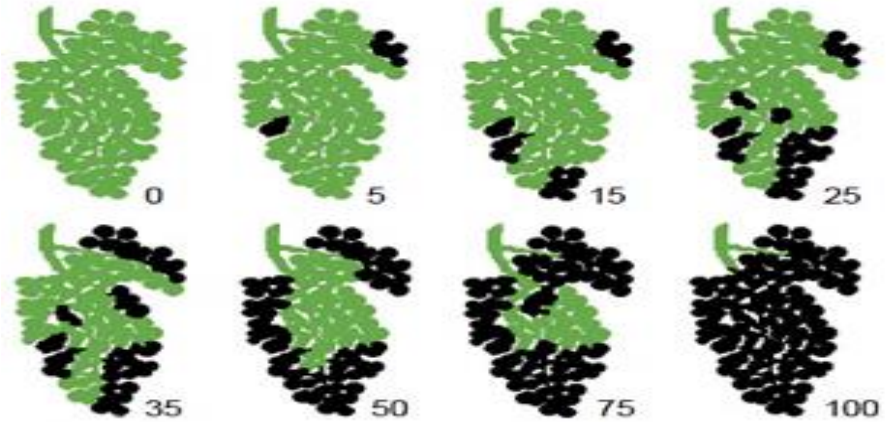
Experimental sites – Res Uvae (Castell'Arquato)

Experimental sites – Gasparini (Piacenza)



Disease and phenological assessment

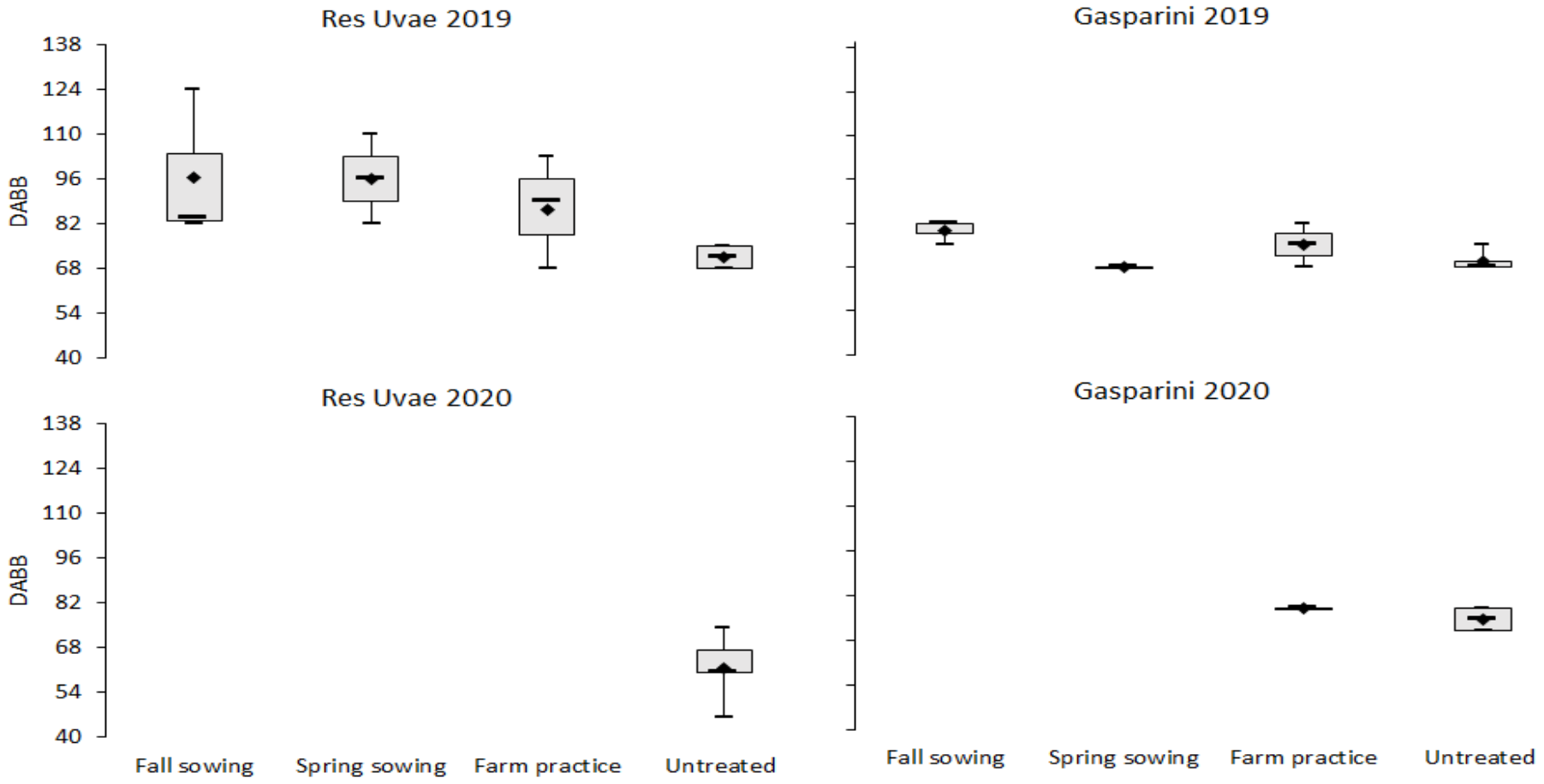




Growth stage	Code	Description
0: Sprouting/Bud development	00	Dormancy: winter buds pointed to rounded, light or dark brown according to cultivar; bud scales more or less closed according to cultivar
	01	Beginning of bud swelling: buds begin to expand inside the bud scales
	03	End of bud swelling: buds swollen, but not green
	05	"Wool stage": brown wool clearly visible
	07	Beginning of bud burst: green shoot tips just visible
	09	Bud burst: green shoot tips clearly visible
1: Leaf development	11	First leaf unfolded and spread away from shoot
	12	2nd leaves unfolded
	13	3rd leaves unfolded
	1 .	Stages continuous till . . .
	19	9 or more leaves unfolded
5: Inflorescence emerge	53	Inflorescences clearly visible
	56	Inflorescences swelling: flowers closely pressed together
	57	Inflorescences fully developed: flowers separating
6: Flowering	60	First flowerhoods detached from the receptacle
	61	Beginning of flowering: 10% of flowerhoods fallen
	62	20% of flowerhoods fallen
	63	Early flowering: 30% of flowerhoods fallen
	64	40% of flowerhoods fallen
	65	Full flowering: 50% of flowerhoods fallen
	66	60% of flowerhoods fallen
	67	70% of flowerhoods fallen
	68	80% of flowerhoods fallen
	69	End of flowering
7: Development of fruits	71	Fruit set: young fruits begin to swell, remains of flowers lost
	73	Berries groat-sized, bunches begin to hang
	75	Berries pea-sized, bunches hang
	77	Berries beginning to touch
	79	Majority of berries touching
8: Ripening of berries	81	Beginning of ripening: berries begin to develop variety-specific colour
	83	Berries developing colour
	85	Softening of berries
	89	Berries ripe for harvest
9: Senescence	91	After harvest: end of wood maturation
	92	Beginning of leaf discolouration
	93	Beginning of leaf-fall
	95	50% of leaves fallen
	97	End of leaf-fall
	99	Harvested product

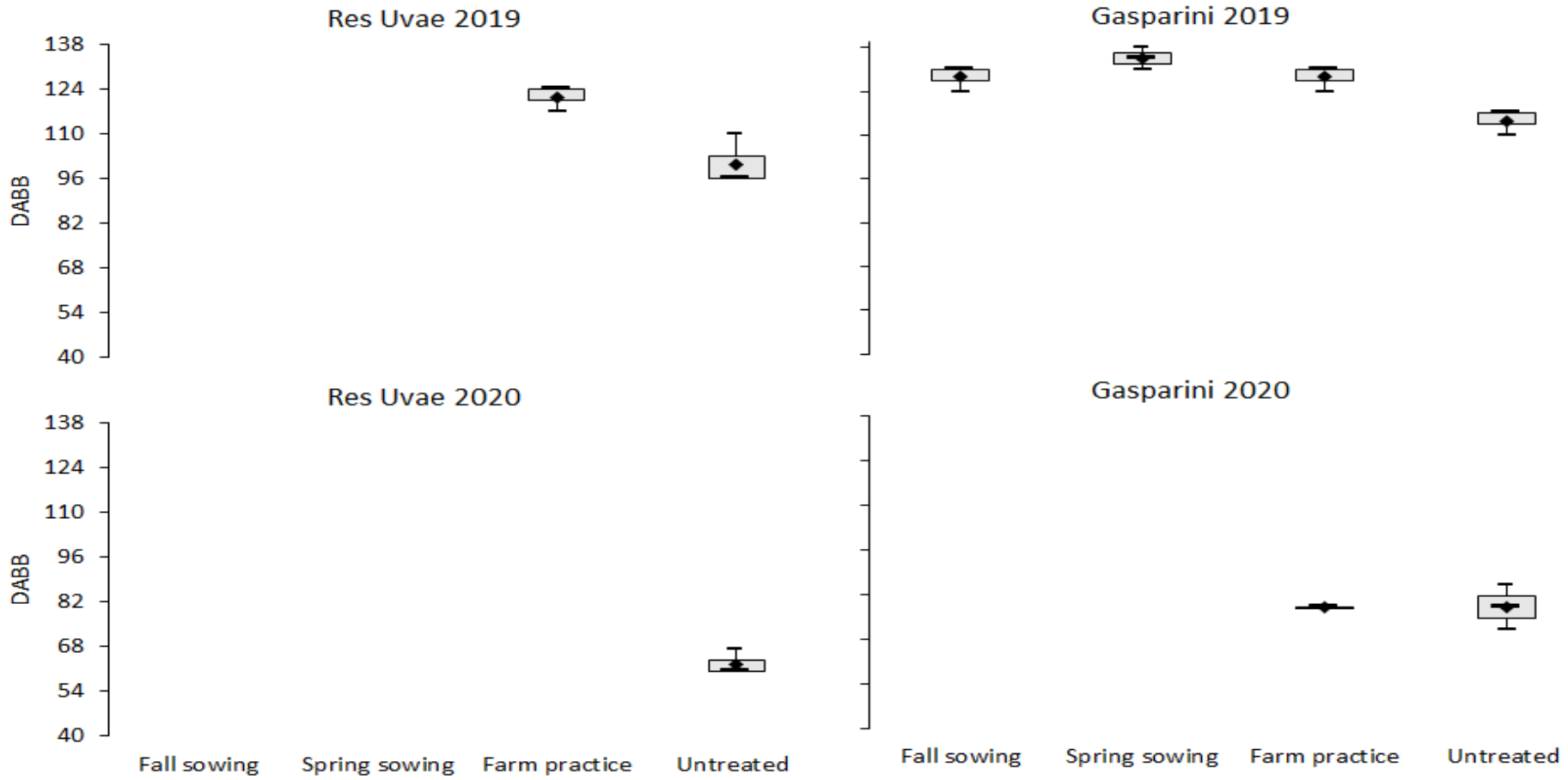
Vegetation of autumn and spring sowing cover crops

Results – *First symptoms of downy mildew onset*



Box plot of the first symptoms onset of downy mildew in the different experimental vineyards in two growing season. The onset dates are expressed as Days After Bud Break (DABB).

Results – *First symptoms of powdery mildew onset*

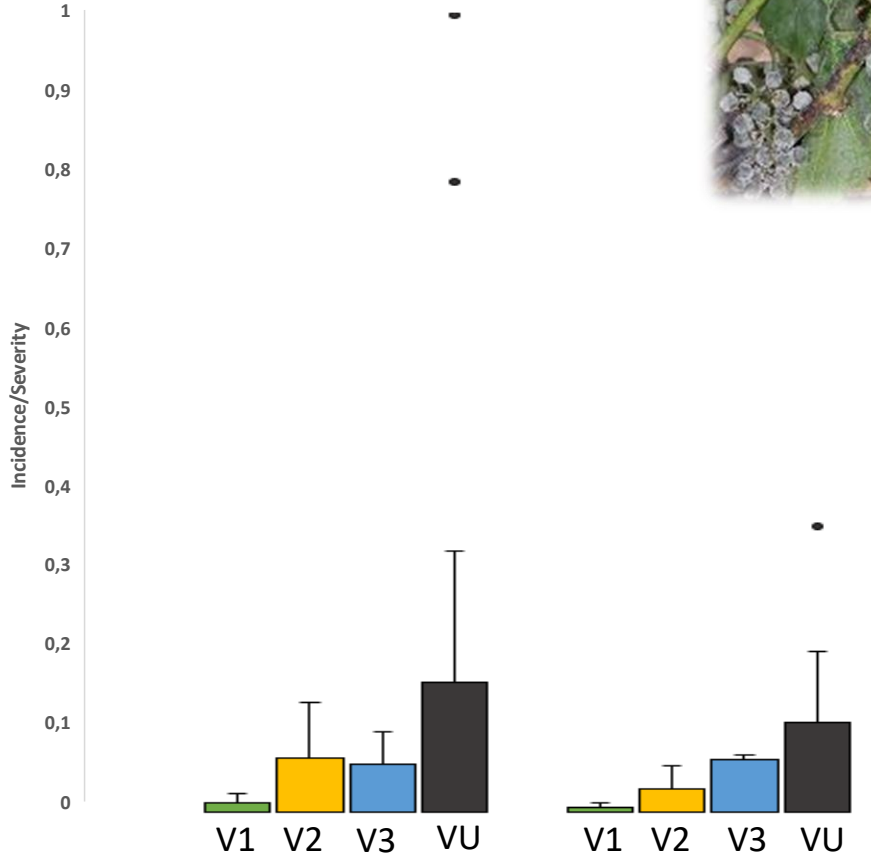


Box plot of the first symptoms onset of powdery mildew in the different experimental vineyards in two growing season. The onset dates are expressed as days after bud break (DABB).

Results – *Diseases Assessment*

Downy mildew

Powdery mildew



Box plot of the diseases incidence and severity assessments of downy and powdery mildew throughout grape growing season in autumn sowing (V1), spring sowing (V2), traditional (V3) and untreated control (VU) plots in two vineyards over two seasons. Boxes contains 50% of the observed cases, whiskers show maximum and minimum while dots represent outliers.

Results from two growing season showed interesting differences between different cropping systems and also between treated and untreated plots

- All viticultural systems tested showed a significant difference compared to the untreated control. Cover crop mixture sowed in autumn showed a significantly reduced downy and powdery mildews pressures also compared to the farm practice

- The effect of the different cover crops on the first seasonal symptoms of soil-transient pathogens was diverse. For *Plasmopara viticola* it was observed approximately 82 days after bud break in Res Uvea and 72 days in Gasparini autumn sown plots in year 2019. Although results from spring sown plots was quite similar in Res Uvea, first onset was observed earlier in Gasparini plots and was similar to control plot. Due to the weather condition there was not much onset of diseases in treated plots in year 2020.

- In the case of a pathogen like *Erysiphe necator*, which overwinters on the grape barks as chasmothecia there was no appearance in innovative plots comparing to control and untreated in Res Uvea in both years. In Gasparini plots however, later onset (124-130 DABB) was observed only in year 2019 and no symptoms in year 2020 comparing to control and untreated plots.

Conclusion

- BIOVINE project showed that there is a genuine potential to develop new viticultural systems based on increased plant diversity within (e.g., cover crops) and/or around (e.g., hedges, vegetation spots, edgings) vineyards by planting selected plant species.
- The results obtained during this project, highlighted the role of cover crop selection and sowing time as relevant factors that should be considered in an integrated disease control strategy
- Selected species have potential to contribute to the control of arthropods, soil-borne pests (oomycetes, fungi, nematodes) as well as foliar pathogens and thereby increase economic, social and environmental sustainability of organic vineyards.
- It can provide organic farmers with strategies to control pests in the vineyard, based on plant diversity to control pests and reduce pesticide dependence.
- It will subsequently lead to higher income and satisfaction of organic winegrowers.

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BIOVINE

Thank you

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