Extended Practice Abstract Nº 11

CLIMED-FRUIT

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Risk management and worker wellbeing on PIWI farms

Challenge

Agriculture is a high-risk sector in terms of work injuries. Worker turnover and seasonal work are critical points for farm management. Therefore, worker well-being, both family workers on family farms and paid workers, is essential for efficiency and social sustainability.

Solution

The cultivation of resistant varieties, such as PIWI, can lead to limited chemical exposure, reduced risk of injury related to tractor and mechanical tool use and a healthier work environment. By planting resistant varieties, farmers reduce treatments in the field, working time, emissions and soil compaction.

Benefits

Higher worker satisfaction — including family workers — will support lasting engagement in climate sustainable practices, such as reducing chemical and fuel use reduction in agriculture.

Applicability box

Theme
Adaptive management
Energy efficiency
Pest management
Soil health
Value chain

Context
Grape production in challenging areas (cool climates, logistical challenges, pest management in touristic areas)

Application time
Any time

Required implementation time
Not identified

Period of impact
Not identified

Equipment
No specific equipment is required.

Practical recommendation

Part of the overall sustainability and support environmental pillar is social sustainability. The workforce must be actively engaged in achieving this kind of sustainability, and there are several areas that influence workplace well-being, according to worker statements. Useful practices are:

- Reducing injuries through resistant varieties and careful pest management
- Providing security plans and individual safety devices
- Security training and specific courses in addition to consolidated security practices
- Managing working time management and following plans, avoiding overload and exhaustion
- Involving workers in decision-making, planning and defining strategies
- Gender sensitivity and equal opportunity practices
- Providing opportunities for personal and professional development such as training, internships, exchanging practices as well as days off to experience something new and different
- Assuring sufficient income, in line with the cost of living

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Figure 1: A harvest day at a PIWI farm

Further information

Videos

[Events – Home (wordpress.com)]

Web links

[Home (wordpress.com)]

Further reading

[Publications – Home (wordpress.com)]

Contact information

Publisher: Prof. Emanuele Boselli, Prof. Federica Viganò, Prof. Guido Orzes, Prof. Stefano Cesco – Free University of Bozen-Bolzano (I)
P.zza Università, 1 – 39100 Bolzano (I) - +390471017217
Website: Home (wordpress.com)
Author(s): E. Boselli, F. Viganò, G. Orzes, S. Cesco, E. Longo, A.T. Ceci, G. Duley, A. Piccoli, P. Sacco
Contact: federica.vigano@unibz.it
Project partners: South Tyrol wineries

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Simplified cost/benefit analysis

PIWI grape variety performance

Introduction – presentation of ex-ante and ex-post situation

PIWI grape varieties are resistant or more tolerant to certain fungal diseases. In specific contexts, such as mountainous or marginal lands, cultivating PIWI varieties could offer several advantages, especially considering that the quality of the wines produced from these grapes is now good. The resistance to particular pathogens, introduced either through traditional breeding programs or advanced techniques like assisted evolution and biotechnological strategies, would enable PIWI varieties to reduce the number of crop protection treatments during grape cultivation. This is significant, as these treatments are among the primary sources of environmental impact in the grape-wine supply chain. Reducing them can also lead to savings in both costs and labour and limiting the rural population's exposure to xenobiotic products. A comparative study was conducted in South Tyrol (46–47° N), a winegrowing region where viticulture is practiced from 220 m a.s.l. to over 1000 m a.s.l., to evaluate the performance of PIWI and non-PIWI varieties.

Economical costs and benefits

For the economic evaluation, the estimations are based on data from the farmer advisory organisation Beratungsring[(1)] and refer to a typical family-run farm in South Tyrol. The typical farm has two permanent employees and additional support during peak work periods. It cultivates 3 ha of vineyards, yielding 10 t/ha·yr. In terms of costs, integrated and organic management practices are considered equivalent.

Legend

Estimated indicator

Measured indicator

	Ex-ante	Ex-post
Crop protection	€2066.57/ha·yr About 16% of total annual costs	
Material (fungicides, insecticides, acaricides)	About 53% of annual material costs Materials account for 11% of total annual costs	About 25% of ex-ante
Machines and equipment (fixed + variable costs)	Account for 26% of total annual costs	About 50% of ex-ante regarding diesel consumption and 40% regarding maintenance costs
Labour	About 5.5% of annual labour costs Labour accounts for 63% of total annual costs	About 2.5% of ex-ante
COMPARISON	Expected cost reduction >27%: 	
Economical benefits: The reduction in variable costs related to crop protection relies on limiting the number of treatments required. Assuming that PIWI varieties allow treatments against fungal pests to be reduced by 50%, the associated reduction in labour and material costs would be approximately 2.5% and 25%, respectively. As far as machinery is concerned, diesel consumption would decrease by 50%, with an estimated 40% reduction in maintenance costs. Considering the impact of these factors on total annual costs, the overall reduction exceeds 27%.		

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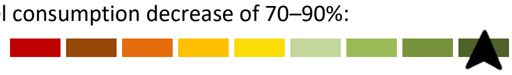
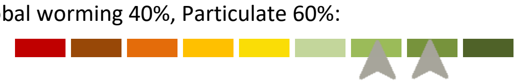
Environmental costs and benefits

Data refer to a two-year period (2022 and 2023) and were collected from four farms located in South Tyrol. The operations considered include crop protection and fertilisation. The number of treatments ranged from three (PIWI) to 20 (organic farm) in a production season. In 2023, the summer was slightly rainier, leading to an increase in treatments on organic farms only. At the provincial level, the rainfall in the April–September period for the areas studied was between 400 and 800 mm/year; at the provincial level again, an anomaly of negative rainfall was recorded in 2022 (-28 mm) and positive in 2023 (+132 mm). In particular, in some of the areas studied in 2023, the rainfall in the months of July and August was approximately double that of the same months in 2022.

The following findings should be considered preliminary and not generalisable. Due to the inherent variability in agricultural systems, further observations will be necessary, both across a wider geographical area and over a longer timeframe.

<table>
<tr><td>Energy</td><td>Fuel consumption decrease of 70–90%:
</td></tr>
<tr><td colspan="2">In 2022, the PIWI vineyard required 80% less diesel compared to the vineyard with highest consumption (using a tractor with similar power) and 70% less than the non-PIWI vineyard on the same farm. In 2023, diesel consumption for treatments was reduced by 90% compared to the vineyard with maximum consumption (similar tractor, different farm) and 80% less than the non-PIWI vineyard on the same farm. This significant reduction is due to the need for fewer treatments as compared to non-PIWI varieties in the observed data, but the effect of the tractor's power should also be noted.</td></tr>
<tr><td>Water</td><td>Further observations are required:
</td></tr>
<tr><td colspan="2">In 2022, a 60% variation was observed in the amount of water used for crop protection treatments, with high amounts required for the PIWI variety. In 2023, non-PIWI varieties showed a 25% increase in water use with respect to 2022, while PIWI varieties registered a reduction between 40% and 57%.</td></tr>
<tr><td>Soil</td><td>Unmeasured impact:
</td></tr>
<tr><td colspan="2">This aspect was not studied in deep detail in the present research to allow for quantification.</td></tr>
<tr><td>Air</td><td>Global worming 40%, Particulate 60%:
</td></tr>
<tr><td colspan="2">Based on life cycle assessment (LCA)[(2)] conducted using observed data referring to 1 ha of cultivated land (ReCiPe Midpoint H method), the reduction in Global warming impact is around 40%, while Fine particulate matter formation is reduced by around 60%, both with respect to the worst non-PIWI variety performer of the dataset considered. This latter indicator, in the specific context, is largely influenced by diesel consumption, which depends on tractor operating hours, power and working conditions.</td></tr>
</table>

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Biodiversity	Not measured:
No direct biodiversity measurements were carried out in the project. However, some results are reported on ecotoxicity indicators and values of plant protection products used, derived from the data processed in the project. It is hoped that sharing this information will be useful for future studies, including the planning of direct field measurements using the appropriate biodiversity indicators. Based on LCA conducted using observed data referring to 1 ha of cultivated land (ReCiPe Midpoint H method), the reduction in Freshwater and Marine ecotoxicity indicators is about 50%. *Terrestrial ecotoxicity* in PIWI varieties is even lower. The reduction is observed in respect of the worst performer (integrated production) and is very high also thanks to the synergic effect of organic farming practices. This last indicator, in this specific context, largely depends on diesel consumption, which depends on the tractor's operating hours, power and working conditions. Fuel consumption information is compatible with 5- to 12-year-old tractors equipped with turbo engines with thermal efficiency ranging from 34% to 37%. In vineyard conditions, engine loads vary between 50% and 80% of the tractors' rated power, with field efficiency indices varying between 65% and 75%. The working context of the vineyards considered is characterised by inter-rows with an average width of 2.2 m and slopes between 10% and 18%. The data indicate a significant reduction in pesticide use for the PIWI vineyard, with a decrease of up to 99% in total active ingredients, 83% for copper and 98% for sulphur. The amount of sulphur used was halved, even though both the copper and sulphur were organically managed. However, it should be noted that these figures are highly dependent on seasonal trends.	

Bibliography and sources

(1) Centro di Consulenza per la fruttiviticoltura dell'Alto Adige: https://www3.beratungsring.org/it/home

(2) ReCiPe LCIA Method: https://www.rivm.nl/en/life-cycle-assessment-lca/recipe

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Extended Practice Abstract Nº 11

SUWIR - Prospects for wines from disease-resistant grape varieties (PIWI wines) in South Tyrol to support sustainability, climate adaptation, corporate social responsibility: a scientific basis for regulatory update

Short description of the project

The project aims to explore the potential of PIWI wines in South Tyrol by comparing their quality and impact with conventional wines. Its key objectives include understanding consumer attitudes, assessing social, environmental and economic impacts for wineries, and developing policy recommendations to support sustainable wine production. The challenges are the different quality characteristics, legislative aspects, consumer awareness of these products, their degree of acceptance, and the assessment of social, environmental and economic impacts for neighbouring businesses also.

Benefits

Wines produced from PIWI varieties may help reduce crop protection operations in vineyards and improve the quality of work in areas with difficult logistics, such as marginal mountain environments.

Stage of implementation

The project is in progress and the data are currently being analysed. The project is scheduled for completion in early 2025.

Key data box

Theme
Grapes; climate change adaptation, wines, value chain, pest management

Context
Grape production in challenging areas (cool climates, logistical challenges, pest management in touristic areas)

Duration
3 years

Partners involved
Free University of Bozen-Bolzano (Italy):
Faculty of Agricultural, Environmental and Food Sciences
Faculty of Education
Faculty of Engineering
Competence Centre on Plant Health
South Tyrolean wine producers (conventional and PIWI)

Particularity
A multidisciplinary approach involving agricultural aspects, chemical instrumental and sensory analysis, engineering and social sciences

Main achieved or expected results

1. *Comparative chemical and sensory analyses of at least 10 wines from disease-resistant grape varieties and their blends versus conventional wines under similar agronomic and technological conditions, providing insights into quality and performance.*
2. *Evaluation of the potential reduction in the use of pesticides and other environmentally harmful practices in vineyards cultivating these varieties.*

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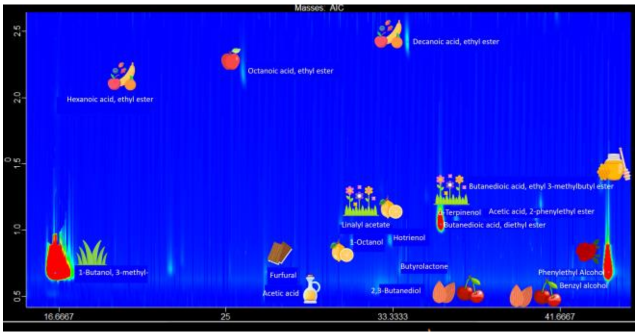
3. *Understanding consumer attitudes and acceptance towards wines from disease-resistant grape varieties (PIWI wines).*
4. *A systematic study of the opinions of producers to understand their perspectives on cultivating these varieties.*
5. *Evaluation of the social, environmental and economic impacts of using disease-resistant grape varieties for wineries, focusing on sustainability benefits.*
6. *Development of policy recommendations to support local stakeholders in transitioning to sustainable viticulture practices and eco-friendly wine production systems.*

Figure 1: Landscape of South Tyrol (Italy)

Figure 2: Solaris' genealogy (white resistant grape variety)



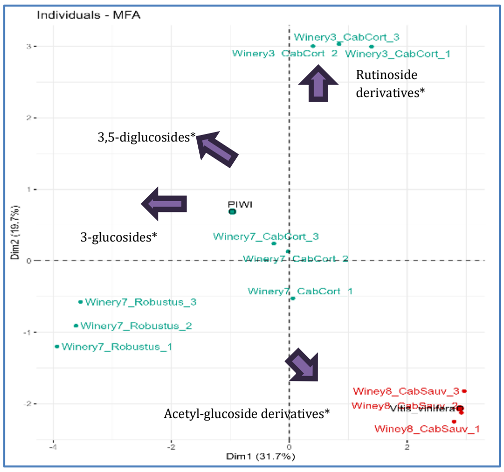


Figure 3: Quality characteristics of PIWI wines: volatile (left) and anthocyanin profiles (right)

Existing materials

Videos: [Events – Home (wordpress.com)]

Website of the Project: [Home (wordpress.com)]

Further Reading: [Publications – Home (wordpress.com)]

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Contact information

Publisher: Prof. Emanuele Boselli, Prof. Federica Viganò, Prof. Guido Orzes, Prof. Stefano Cesco – Free University of Bozen-Bolzano (I)
P.zza Università, 1 – 39100 Bolzano (I) - +390471017217
Website: Home (wordpress.com)

Author(s): E. Boselli, F. Viganò, G. Orzes, S. Cesco, E. Longo, A.T. Ceci, G. Duley, A. Piccoli, P. Sacco

Contact: emanuele.boselli@unibz.it

Project partners: South Tyrol wineries

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Project website: https://climed-fruit.eu/

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