

## Introduction

Tuscany is one of the world's leading wine-growing regions, with 60,000 hectares of vineyards, predominantly located on moderately elevated hills. In recent years, climate change has progressively driven viticulture toward higher elevations, expanding into areas previously limited to small-scale, family-owned production. Currently, vineyards above 500 m a.s.l. cover approximately 1,300 hectares, mostly consisting of recent plantings. In high altitude conditions, marked diurnal temperature fluctuations promote gradual ripening, enhanced aromatic expression, and acidity preservation, contributing to freshness and structural complexity in wines. On the other side, the shift to higher elevations presents several agronomic challenges, particularly in **varietal choice** and **vineyard management**. In addition, mountain environments are often affected by **spring cold spells**, while **reduced thermal accumulation** during the growing season may alter phenological development, potentially reducing floral induction and yield. Additionally, the increasing frequency of extreme weather events, such as intense summer **storms** and **hail events**, represents a significant threats, requiring vinegrowers to adopt protective strategies.

## Distribution of Vineyard Area by Altitude and Varietal Composition <sup>1</sup>

**Table 1.** Upslope shift in vineyard area above 500 m a.s.l. (2018–2025)

Altitude (m a.s.l.)	2018 (hectares)	2025 (hectares)	Variation
500-600	1026	1118	+ 9 %
600-700	126	165	+ 31 %
700-800	15	23	+ 53 %
>800	0,4	8,2	+ 1950 %

**Table 2.** Percentual of vineyard area above 500 meters sea level in 2025 by aspect

Altitude	North East	North	North West	South East	South	South West	East	West
500-600	7,3%	6,7%	10,1%	15,5%	19,1%	17,8%	8,7%	14,8%
600-700	6,8%	5,7%	7,7%	9,6%	23,3%	16,3%	6,1%	24,5%
700-800	1,8%	6,1%	5,9%	5,5%	14,4%	27,4%	0,4%	38,5%
>800	0,0%	0,0%	0,0%	16,4%	24,8%	33,9%	13,5%	11,4%

Between 2018 and 2025, vineyard area expanded markedly above 500 m a.s.l., with the strongest relative increase occurring at elevations above 700 m. Despite the smaller absolute area at higher altitudes, this trend indicates a progressive upward shift of Tuscan viticulture.

The distribution by aspect indicates a higher proportion of vineyard area on south-facing slopes (especially south, south-east, and south-west) at increasing altitudes.

**Table 3.** Vineyard above 500 m a.s.l. Most widespread varieties by color

	Altitude (m a.s.l.)			
	500 - 600	600 - 700	700 - 800	>800
<b>Red varieties</b>				
Sangiovese	76%	76%	7%	15%
Merlot	8%	4%	34%	16%
Pinot noir	4%	10%	28%	53%
Syrah	1%	1%	13%	9%
<b>Total red.</b>	<b>90%</b>	<b>92%</b>	<b>83%</b>	<b>92%</b>
<b>White varieties</b>				
Chardonnay	24%	54%	90%	68%
Sauvignon	18%	21%	1%	0%
Pinot blanc	16%	0%	0%	4%
Trebbiano	12%	10%	2%	0%
Riesling	3%	0%	7%	15%
Chasselas doré	0%	0%	0%	11%
<b>Total white</b>	<b>72%</b>	<b>86%</b>	<b>99%</b>	<b>97%</b>

At higher elevations, varietal composition shows an increasing presence of short-cycle, non-local varieties, while the relative share of traditional grapes declines. This shift is particularly evident in the highest altitude classes. Furthermore, vineyard composition shifts toward a higher proportion of white varieties with increasing elevation.

**Table 4.** Vineyard area above 500 m a.s.l. by grape color

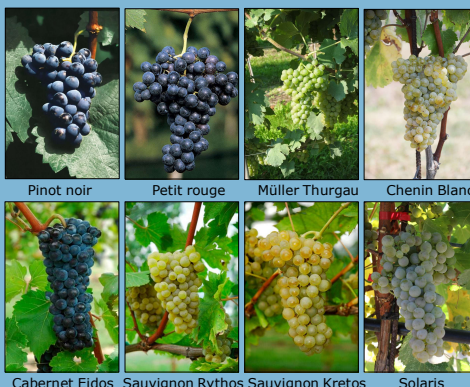
Varieties	Altitude (m a.s.l.)			
	500 - 600	600 - 700	700 - 800	>800
<b>Total red</b>	<b>92%</b>	<b>74%</b>	<b>30%</b>	<b>63%</b>
<b>Total white</b>	<b>8%</b>	<b>26%</b>	<b>70%</b>	<b>37%</b>



## Experimental Vineyard

In 2025, the first high altitude experimental vineyard in the Tuscan Apennines (Pistoia province) was established to generate knowledge **supporting vineyard management** in generally poorly studied mountain environments, where viticulture is not traditionally practiced.

The vineyard includes both traditional *Vitis vinifera* cultivars and disease-resistant varieties (PIWI), with the broader objective of promoting sustainable viticulture in a high value and fragile ecosystem.



**Surface:** 0.5 hectare **Aspect:** South West  
**Altitude:** 805 a.s.l **Slope:** 10%



**First harvest and results 2027**