Elisa De Luca
Vivai Cooperativi Rauscedo

Resistant Varieties: New Perspectives for a More Sustainable Viticulture

What are the New Finding Obtained during the Project ?

FIELD TRIALS: RESISTANT VARIETIES

X

SUSCEPTIBLE VARIETIES

Tocai friulano
Sauvignon
Merlot
(Cabernet sauvignon)

RESISTANT VARIETIES

20-3 (Bianca x SK77-4/5; SK77-4/5 = Kumbarat x Traminer)
Bianca (Bouvier x Eger2; Bouvier = free pollination of Pinot; Eger = self-pollination of Villard blanc)

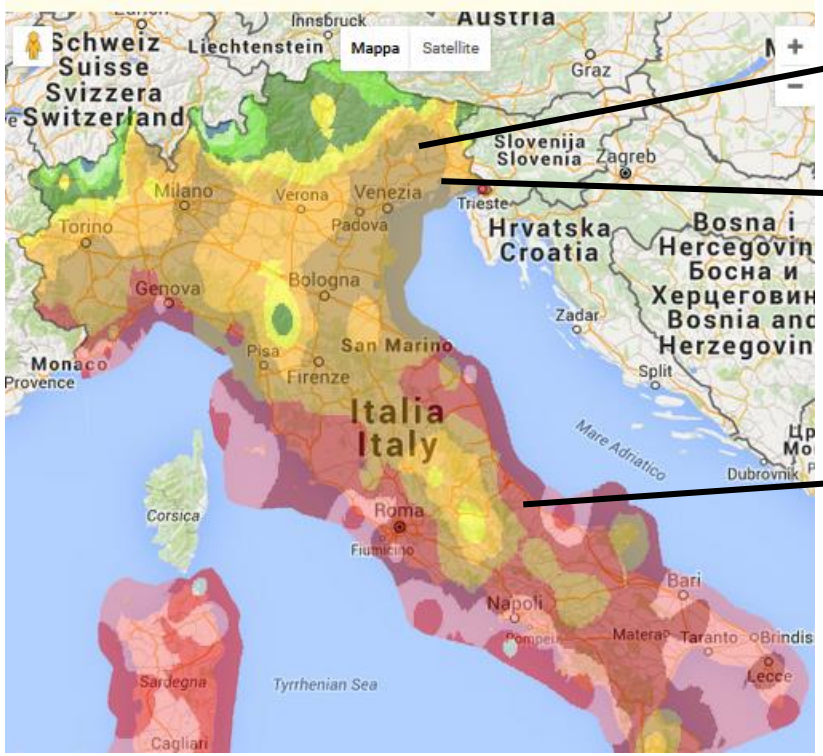
Fleurtai (UD. 34-111, Tocai f. x 20-3)
Soreli (UD. 34-113, Tocai f. x 20-3)
Sauvignon maris (UD. 30-080, Sauvignon x 20-3)
Sauvignon kretos (UD. 76-026, Sauvignon x 20-3)
UD. 31-120 (Merlot x 20-3)
UD. 31-103 (Merlot x 20-3)

FIELD TRIALS: MEASURES

- **Vegetative controls** (phenology, n° of shoots, pruning weight, Ravaz index, shoot diameter)
- **Productive controls** (fertility, plant production, yield, n° grapes/meter, bunch and berry weight), statistical analysis.
- **Oenological traits** (must and wine parameters)
- **Microvinifications** (site 1 Fossalon, site 2 Rauscedo and site 3 Ripa Teatina) and tasting sessions
- **Sanitary controls** (Powdery and Downy mildew infections)

FIELD TRIALS: LOCATION OF THE EXPERIMENTAL VINEYARDS

	TRADITIONAL PRACTICE: conventional varieties					INNOVATIVE PRACTICE: resistant varieties					
LOCATION	Tocai f.	Merlot	Sauv. b.	Syrah/Glera	Montep.	Sauvignon maris (UD.30-080)	UD.31-103	UD.31-120	Fleurtai UD.34-111	Soreli UD.34-113	Sauvignon kretos UD.76-026
SITE 1-North costal	X	X	X	X		X	X	X	X	X	X
SITE 2 North-mainland	X	X	X					X	X	X	X
SITE 3-Central					X		X	X	X	X	X



SITE 2: Rauscedo (PN), north-mainland

SITE 1: Fossalon di Grado (PN), north-coastal

SITE 3: Ripa Teatina (CH), central

USDA Hardiness Zone Map

FIELD TRIALS: CHARACTERISTICS OF THE SITES

SITE 1: FOSSALON (GO)
north-coastal

SOIL: silt-loam, sub-alkaline, moderate-calcareous
LOCATION: alluvial plane, coastline, reclaimed
ELEVATION: - 1 m AMSL
USDA : 8
RAINFALL: 1055 mm (674 from April to September)
RH (vegetative period): 71 %
T° max (average of July): 28°C
T° min (average of January): -1° C
GDD: 1770° C

SITE 2: RAUSCEDO (PN)
north-mainland

SOIL: sandy-loam, alkaline, calcareous, well drained
LOCATION: alluvial plane, mainland

ELEVATION: 83 m AMSL
USDA : 8
RAINFALL: 1495 mm (800 from April to September)
RH (vegetative period): 80 %
T° max (average of July): 28°C
T° min (average of January): -2° C
GDD: 1640° C

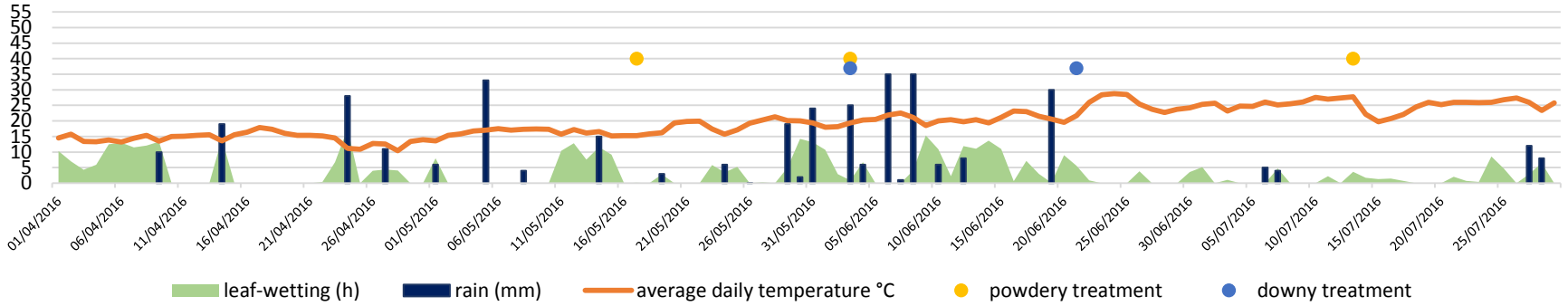
SITE 3: RIPA TEATINA (CH)
central

SOIL: sandy-clay-loam, neutral or sub-alkaline
LOCATION: coastal hills

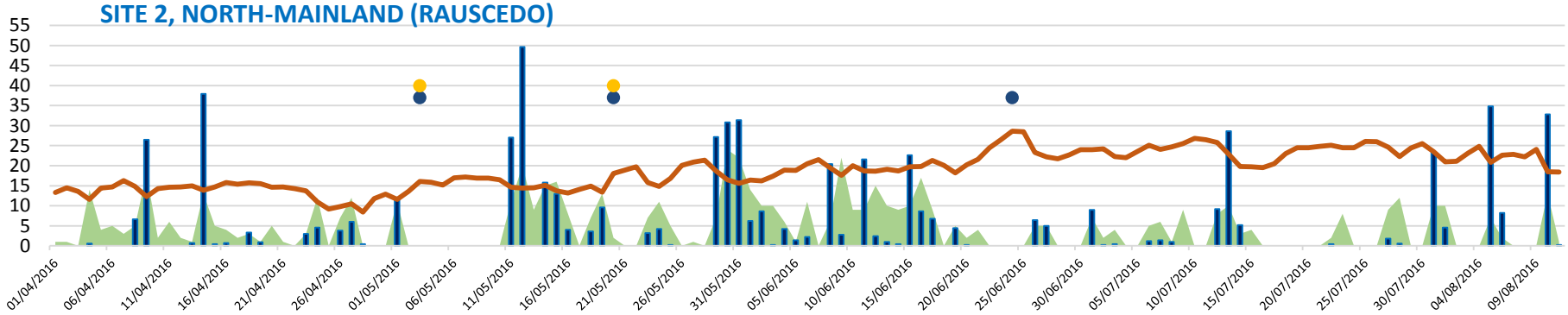
ELEVATION: 199 m AMSL
USDA : 9 b
RAINFALL: 676 mm (283 from April to September)
RH (vegetative period): 70 %
T° max (average of July): 30°C
T° min (average of January): 2° C
GDD: 1814° C

METEO STATIONS: AVERAGE DAILY TEMPERATURE(°C), RAINFALLS (mm), LEAF-WETTING (h) SEASON 2016

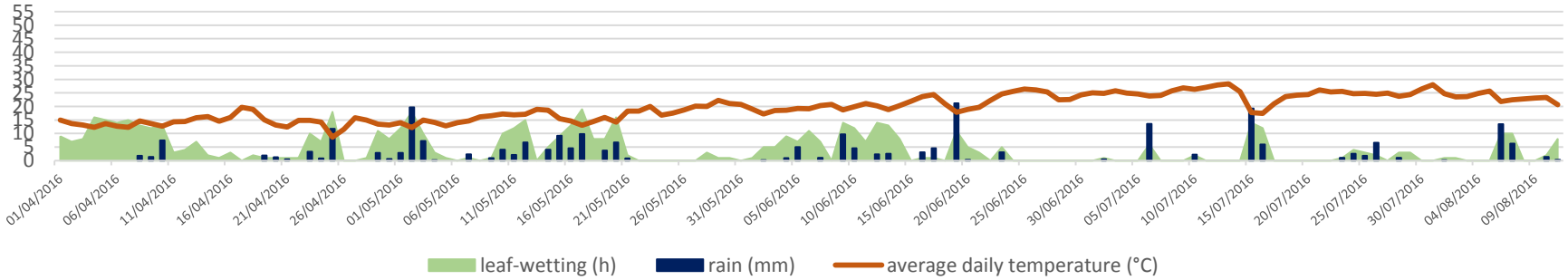
SITE 1, NORTH-COASTAL (FOSSALON)



SITE 2, NORTH-MAINLAND (RAUSCEDO)



SITE 3, CENTRAL (RIPA TEATINA)



METEO STATIONS: AVERAGE DAILY TEMPERATURE(°C), RAINFALLS (mm), LEAF-WETTING (h)

WHAT'S RELEVANT IN 2016 WEATHER TREND:

- Heavy rains during bloom, in northern sites, and during ripening in Central Italy
- Long-lasting leaf-wetting periods with very disease-favorable temperatures
- High disease aggressivness and frequency in all sites

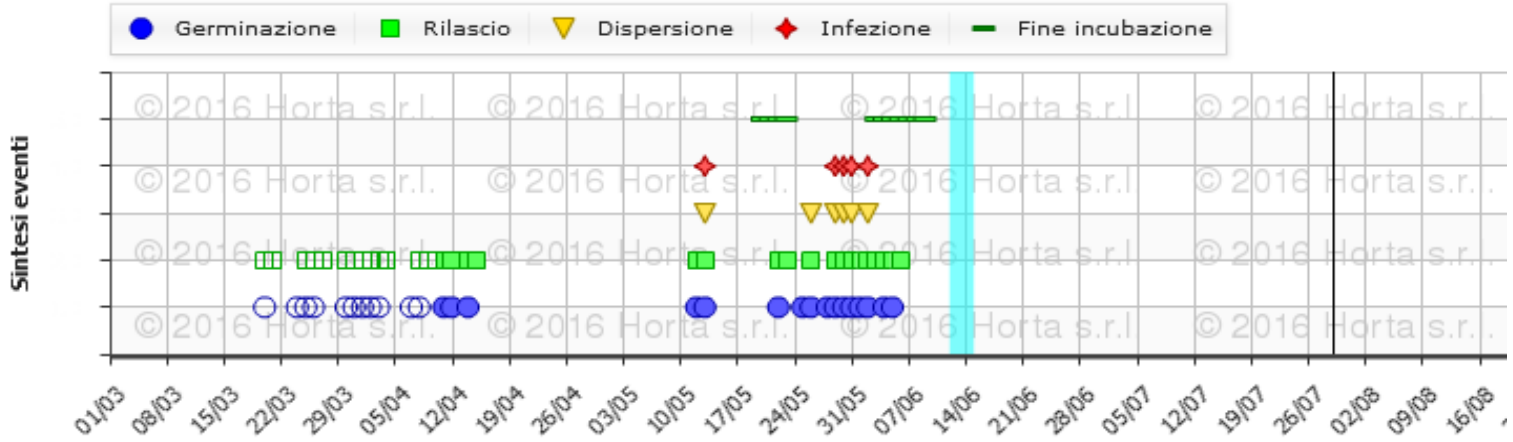
POTENTIAL OF MILDEW INFECTIONS:

- **Horta's DSS (decision support system) (vite.net)**, that provides information about the number and timing of infections
- visual inspections of non-treated controls.

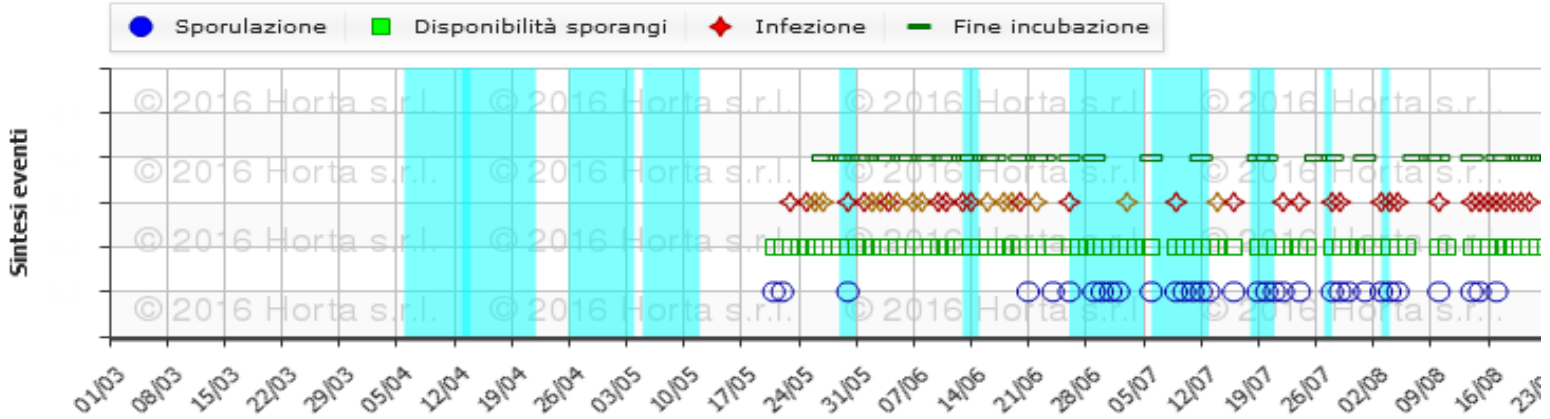
MILDEW INFECTION POTENTIAL ESTIMATED BY **Horta's DSS (decision support system),**

DOWNY MILDEW INFECTIONS IN SITE 1, NORTH-COASTAL (FOSSALON)

PRIMARY INFECTIONS



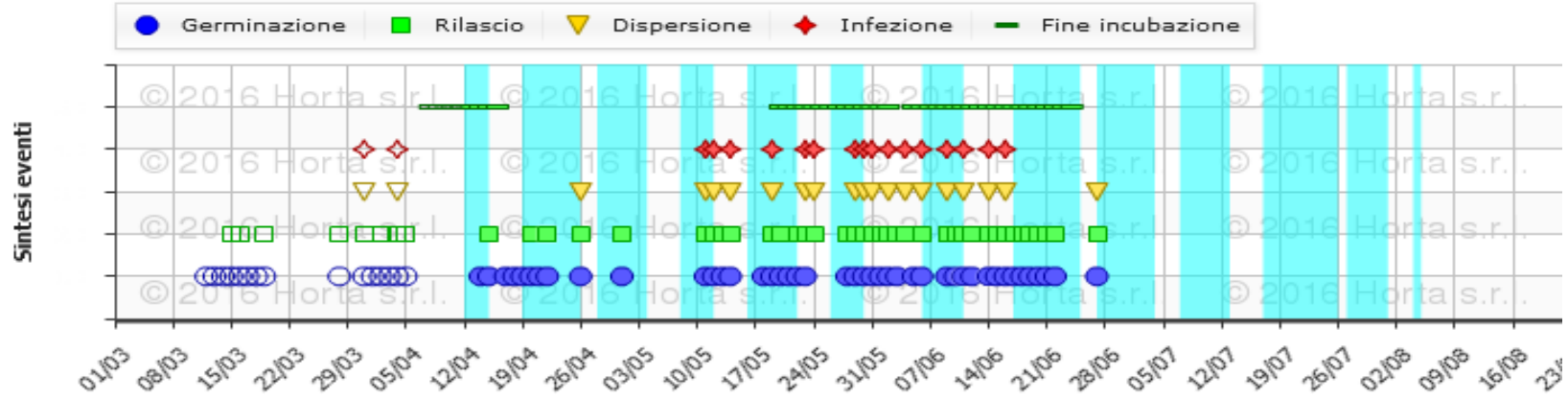
SECONDARY INFECTIONS



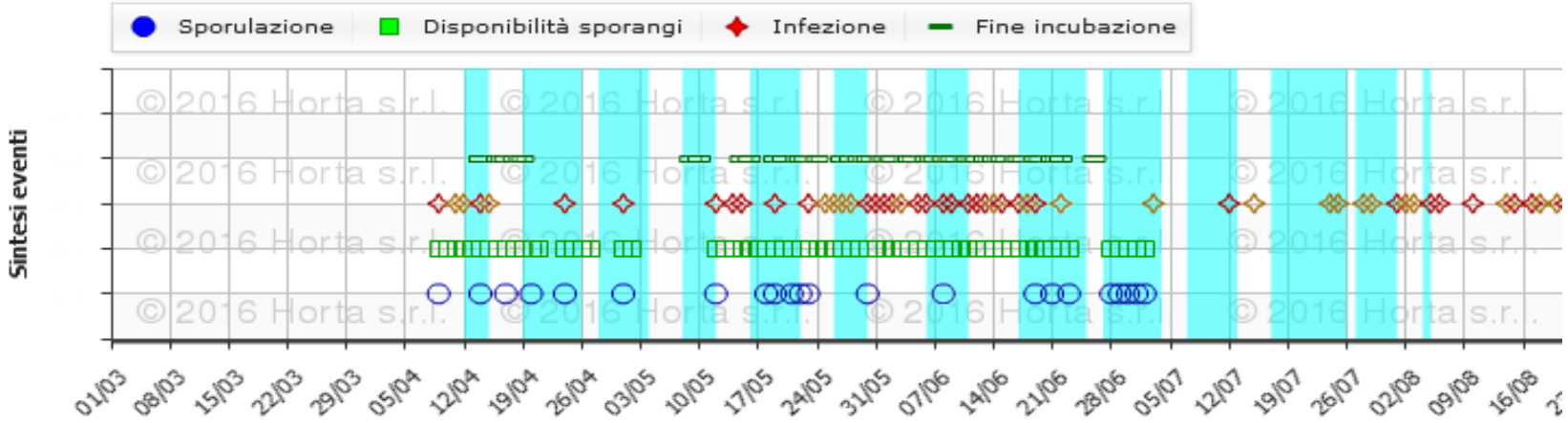
MILDEW INFECTION POTENTIAL ESTIMATED BY **Horta's DSS (decision support system),**

DOWNY MILDEW INFECTIONS IN SITE 2, NORTH-MAINLAND (RAUSCEDO)

PRIMARY INFECTIONS



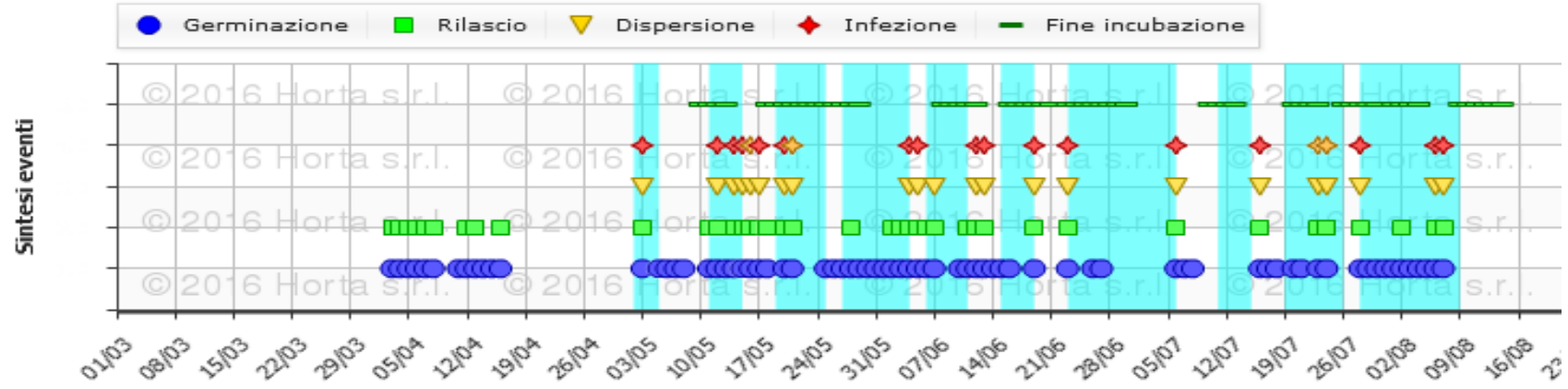
SECONDARY INFECTIONS



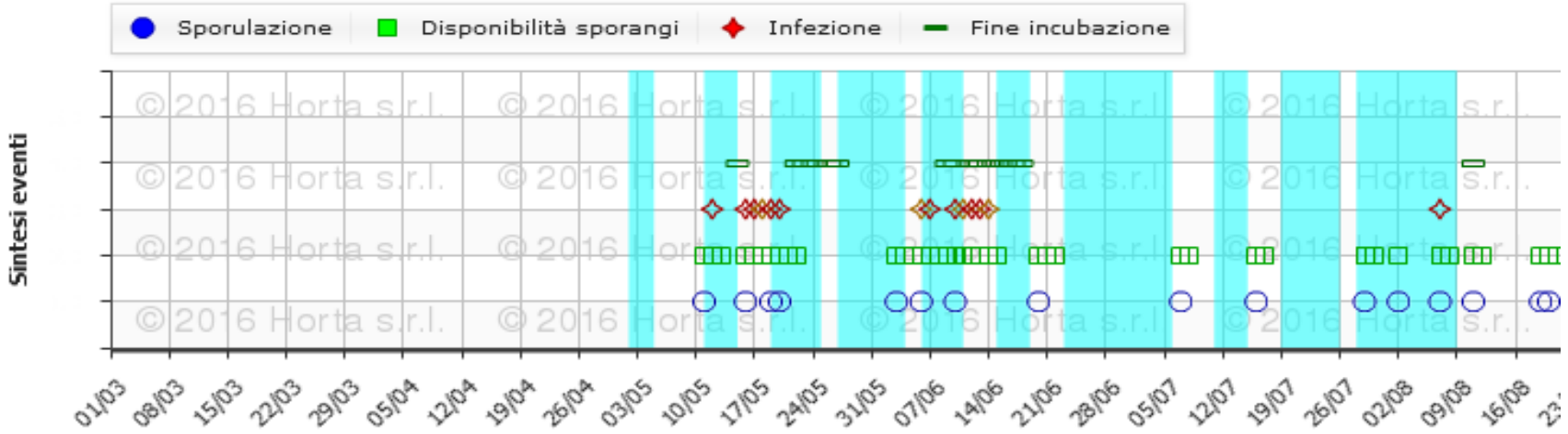
MILDEW INFECTION POTENTIAL ESTIMATED BY **Horta's DSS (decision support system),**

DOWNY MILDEW INFECTIONS IN SITE 3, CENTRAL (RIPA TEATINA)

PRIMARY INFECTIONS



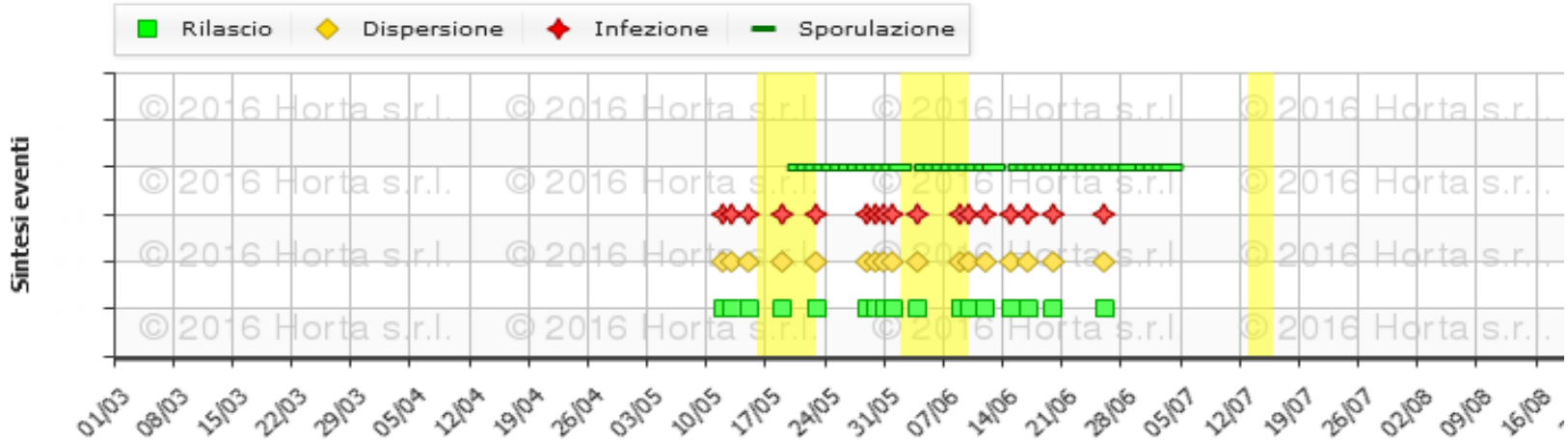
SECONDARY INFECTIONS



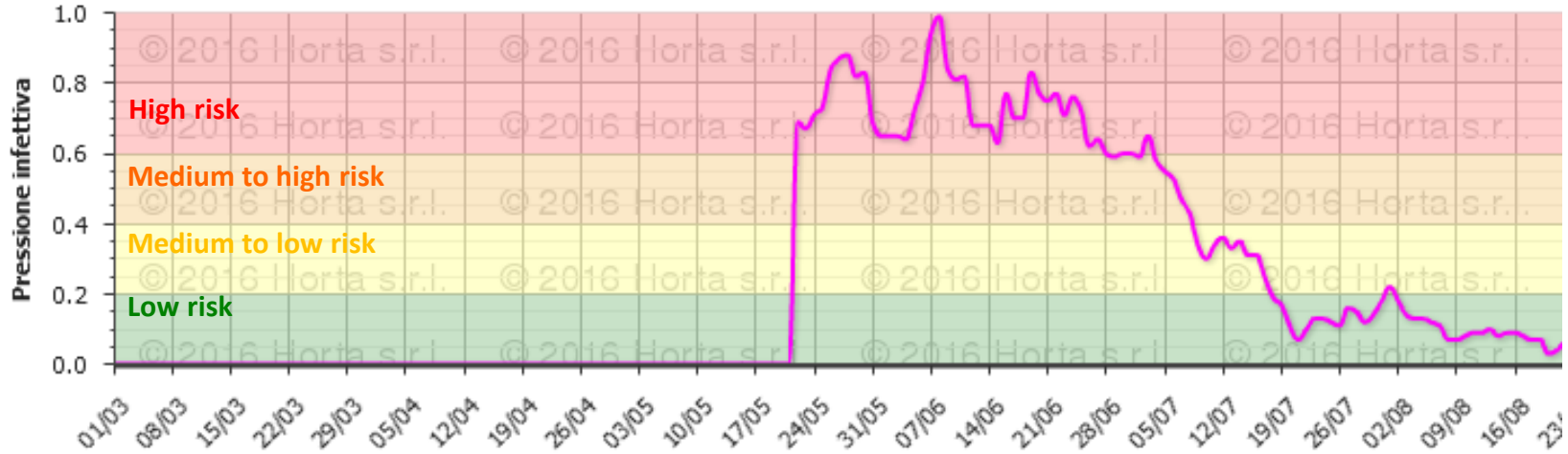
MILDEW INFECTION POTENTIAL ESTIMATED BY **Horta's DSS (decision support system),**

POWDERY MILDEW INFECTIONS IN SITE 1, NORTH-COASTAL (FOSSALON)

ASCOSPORES



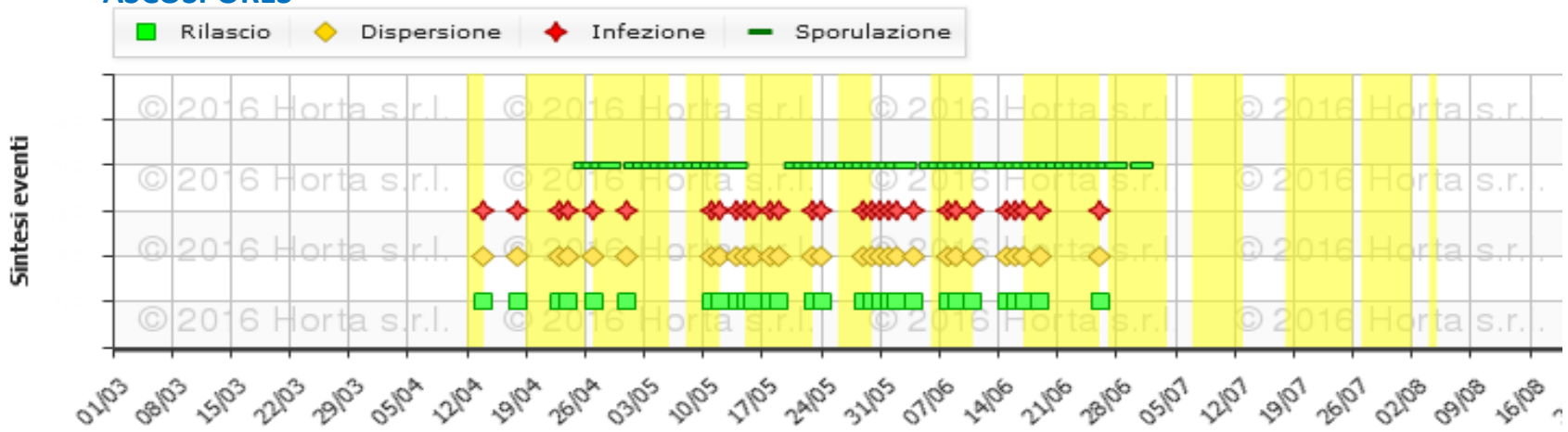
DISEASE PRESSURE



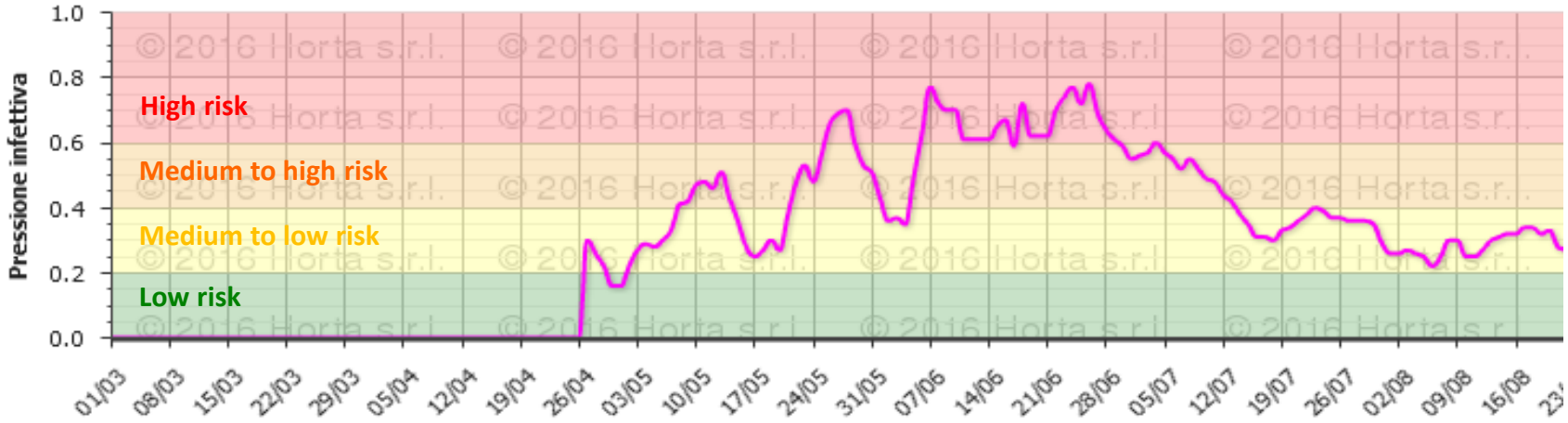
MILDEW INFECTION POTENTIAL ESTIMATED BY **Horta's DSS (decision support system),**

POWDERY MILDEW INFECTIONS IN SITE 2, NORTH-MAINLAND (RAUSCEDO)

ASCOSPORES



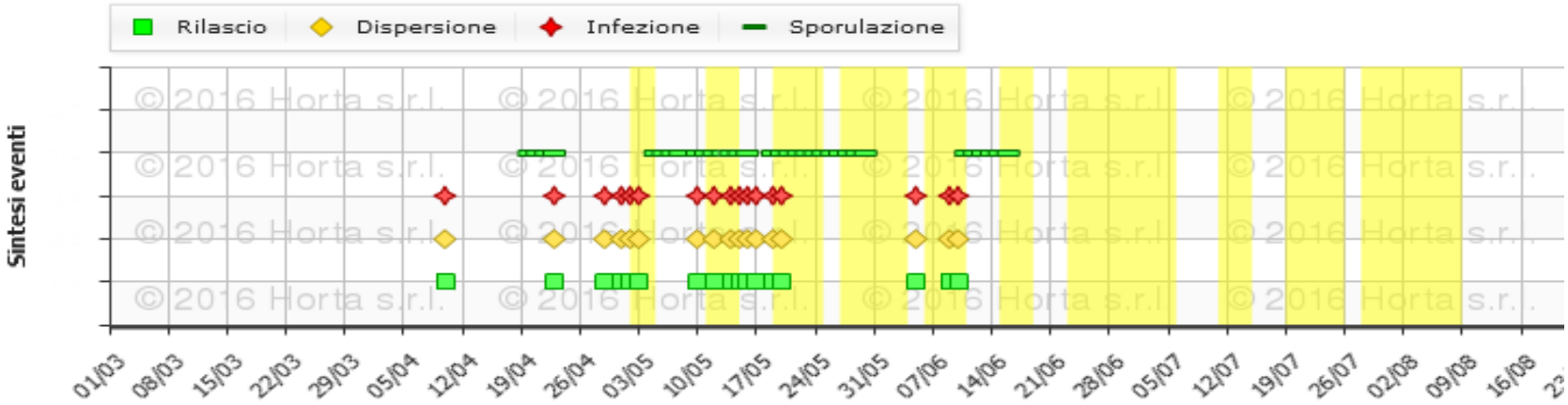
DISEASE PRESSURE



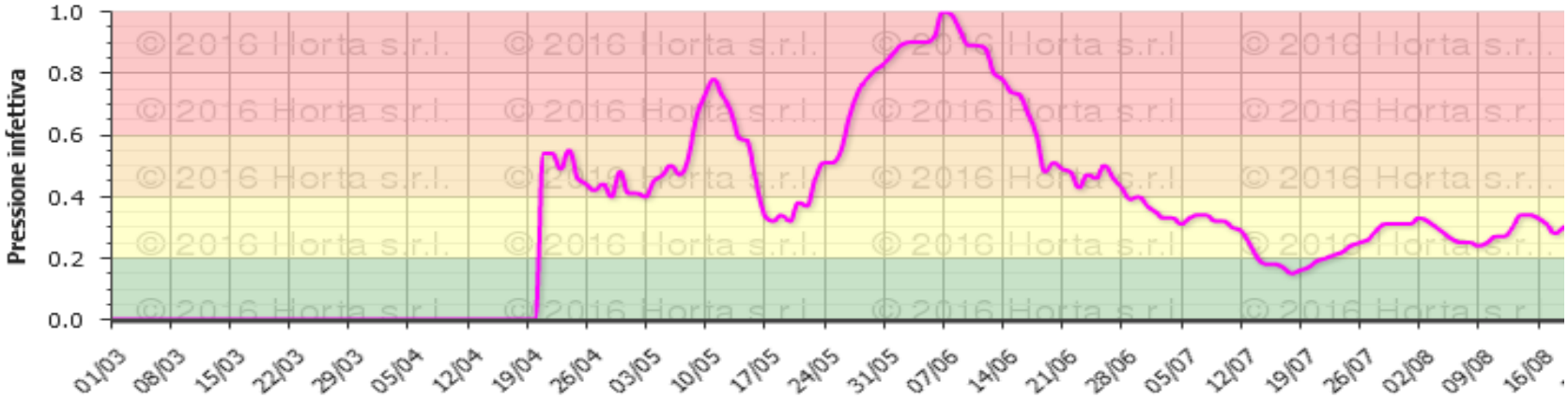
MILDEW INFECTION POTENTIAL ESTIMATED BY **Horta's DSS (decision support system)**

POWDERY MILDEW INFECTIONS IN SITE 3, CENTRAL (RIPA TEATINA)

ASCOSPORES



DISEASE PRESSURE

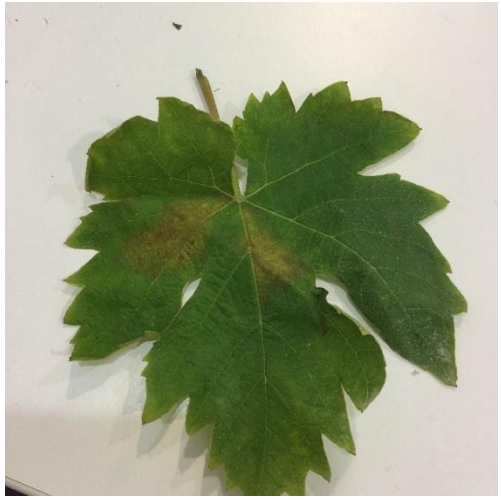


MILDEW INFECTION POTENTIAL ESTIMATED BY **Horta's DSS (decision support system)**

SUMMARY OF HORTA'S DSS OUTPUT

	DISEASE PRESSURE, YEAR 2016			
	N°DOWNY MILDEW INFECTION		N° POWDERY MILDEW	
	PRIMARY	SECONDARY	ASCOSPORES	MEDIUM TO HIGH RISK
Site 1, north-coastal (Fossalon)	5	69	17	22/05/16 to 09/07/16
Site 2, north-mainland (Rauscedo)	18	69	29	20/04/16 to 30/07/16
Site 3, central (Ripa Teatina)	21	28	17	21/04/16 to 10/07/16

Conventional variety **Montepulciano***: infection of downy mildew, site 3, Central Italy (07/07/2015)

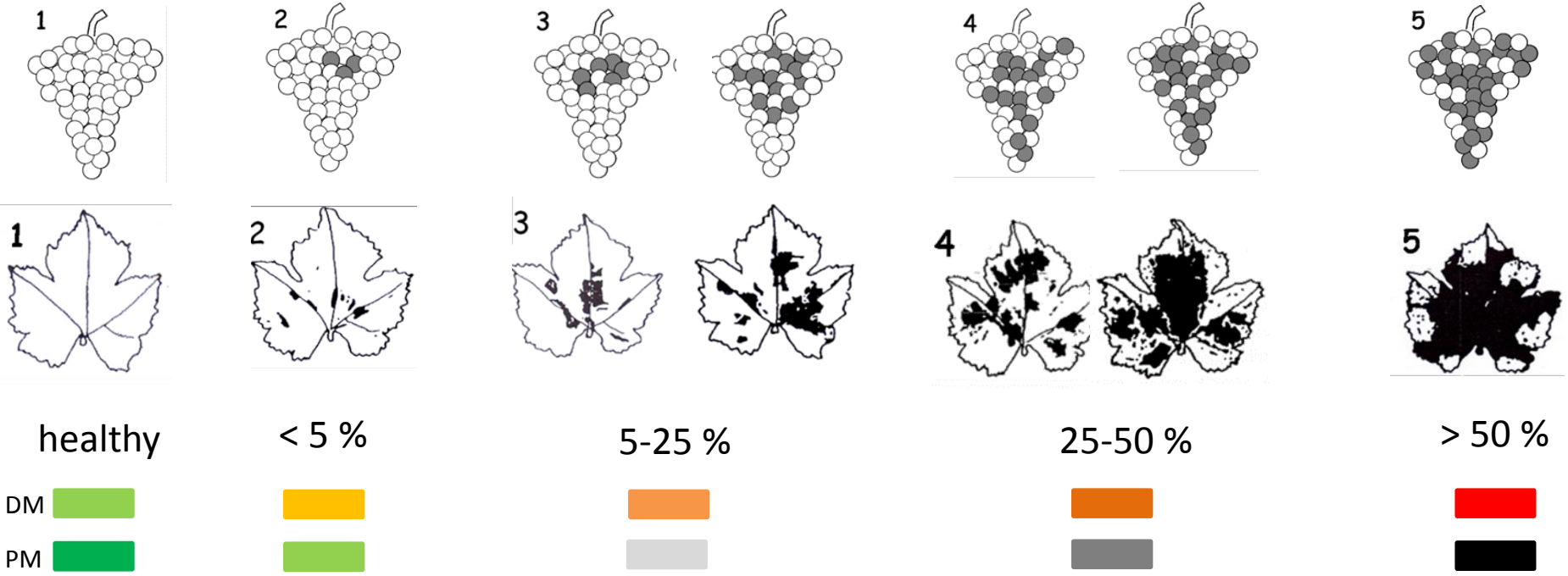


First downy mildew symptoms on leaf in **Montepulciano*** variety, site 3, Central Italy (19/05/2016)

First downy mildew symptoms on leaves of **Glera**** variety, site 1, north-mainland (27/05/2016)

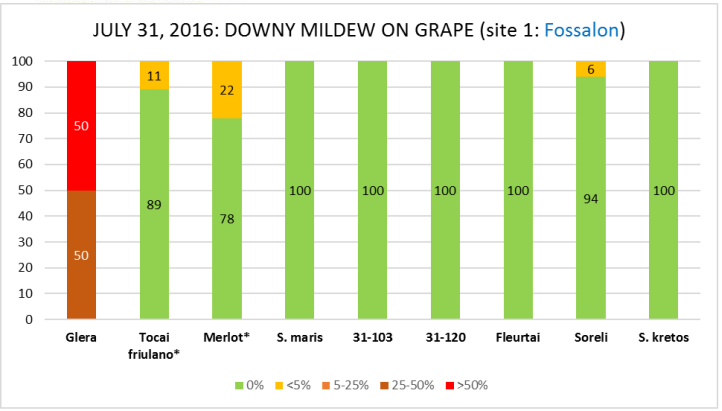
* Organic treatment protocol, ** Conventional treatment protocol

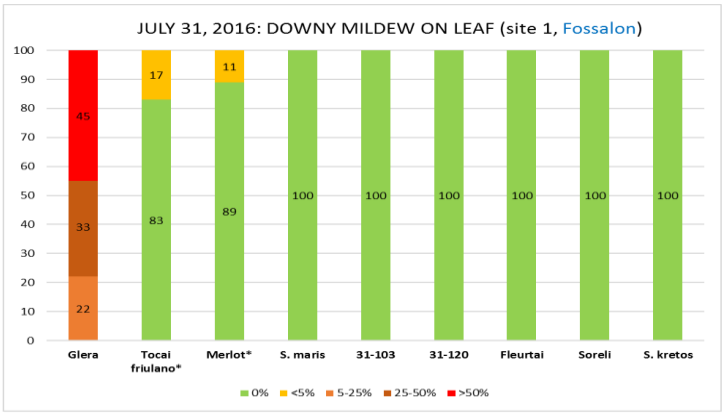
MILDEW INFECTION: SCALE OF SERIOUSNESS

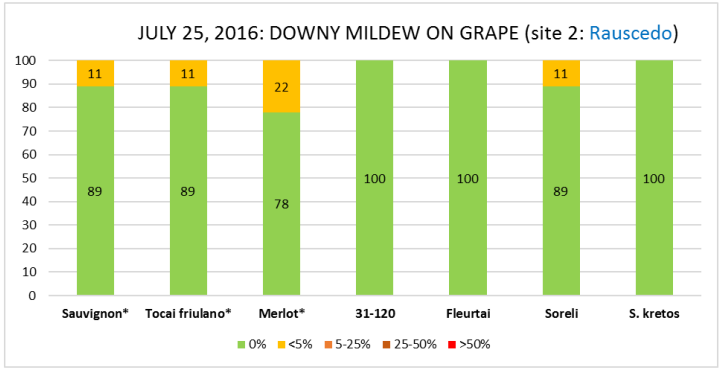


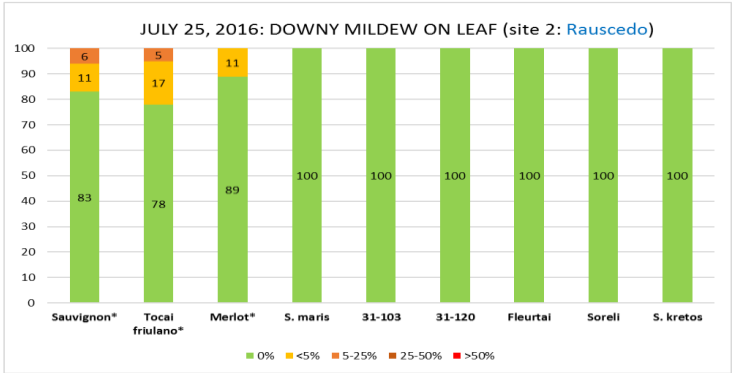
Disease resistance assessed through visual inspections (3 seasonal inspections). Disease scoring taken in accordance to OIV descriptors.

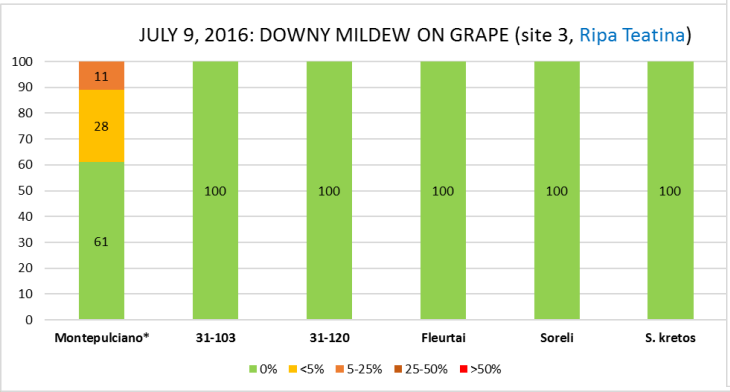
DOWNY MILDEW INFECTION: INCIDENCE AND SERIOUSNESS, YEAR 2016

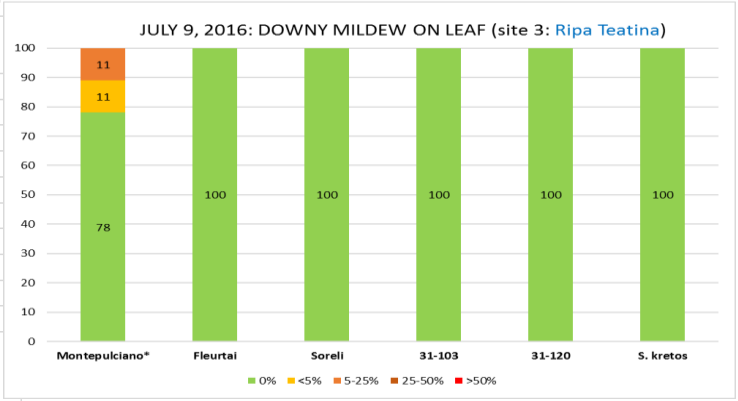










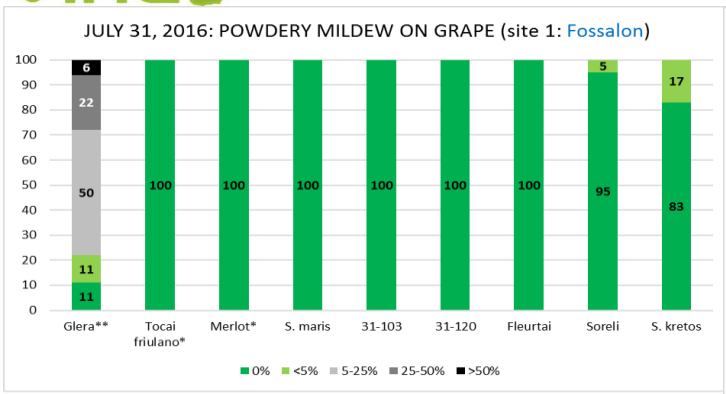


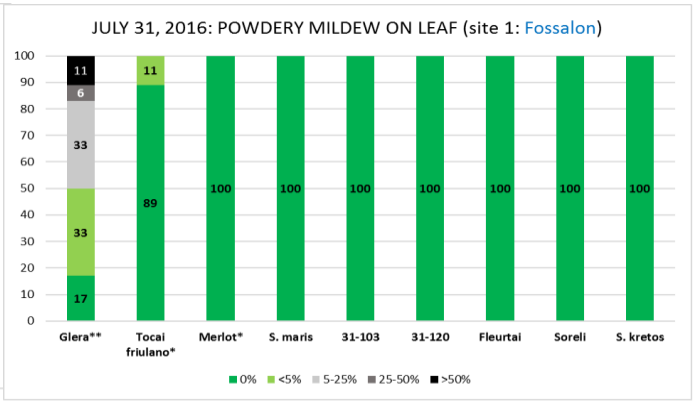
Site 2. Conventional variety cultivated in pots , not-treated control (22/08/2016)

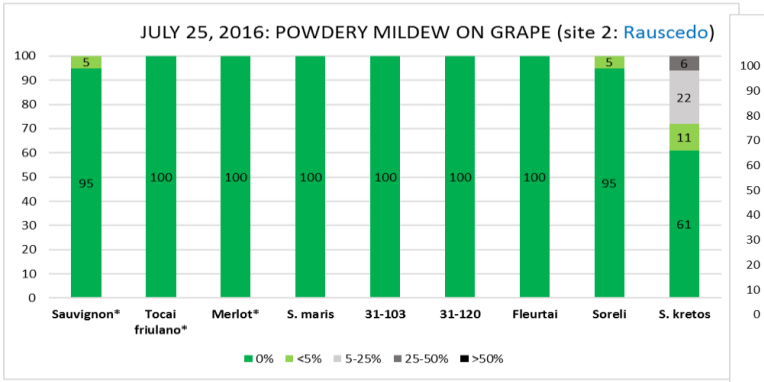
Site 1: Glera, not-treated control (29/07/2016)

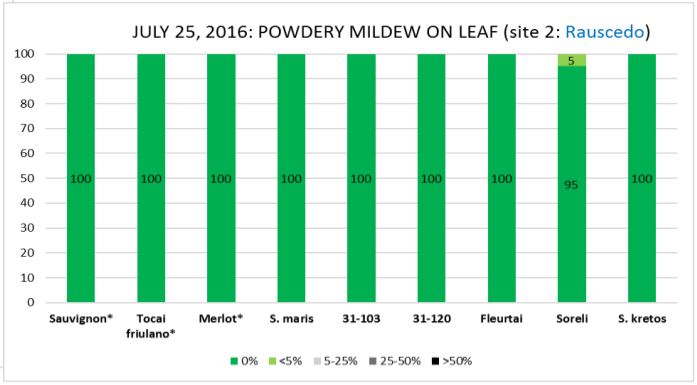
Site 1: Soreli (29/07/2016)

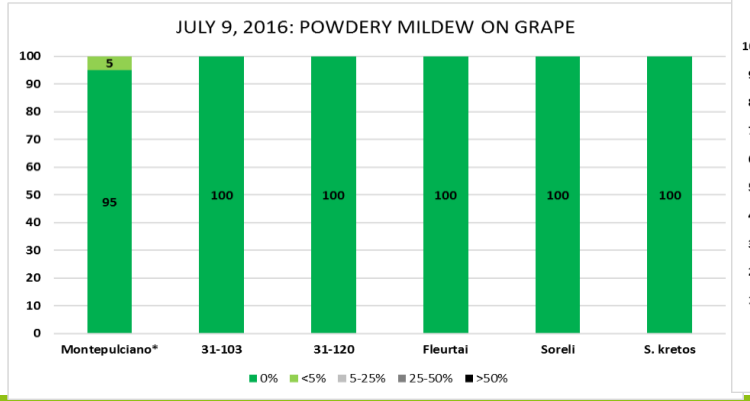
POWDERY MILDEW INFECTION: INCIDENCE AND SERIOUSNESS, YEAR 2016

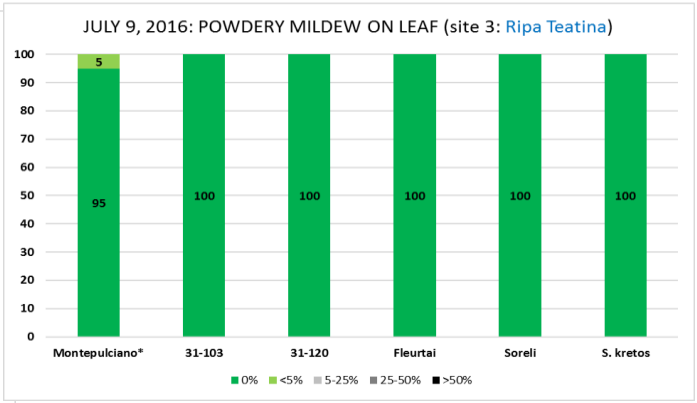








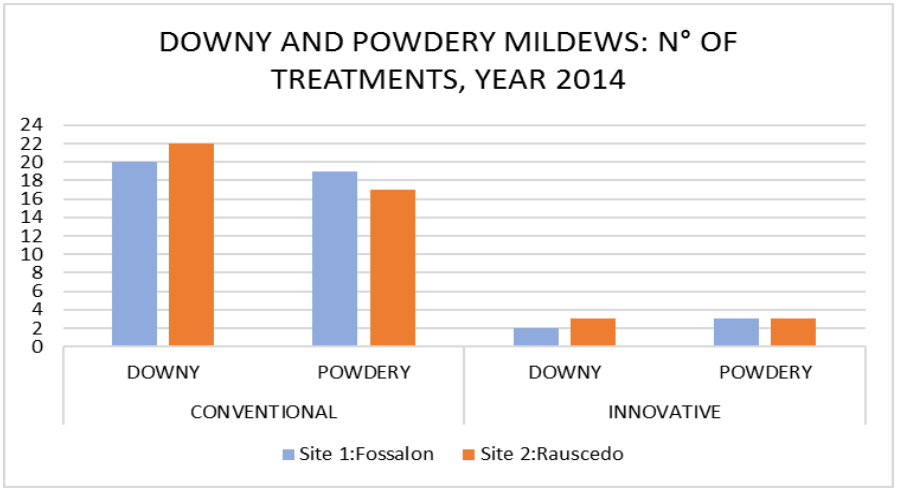


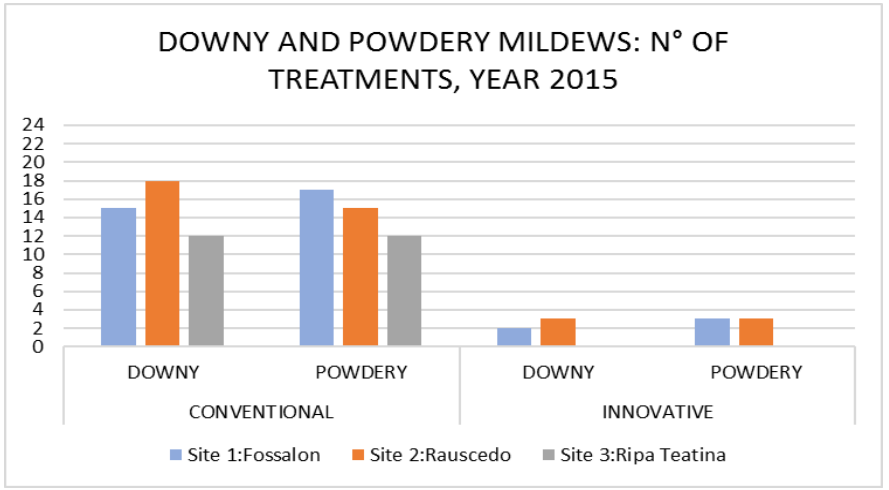


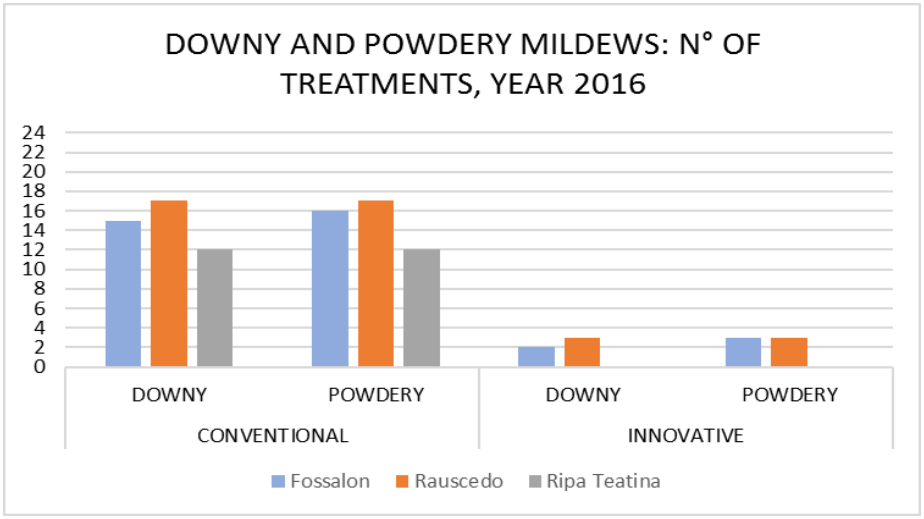
Site 2: Sauvignon Kretos (07/07/2016)

Site 1: Soreli (01/07/2016)

N° OF TREATMENTS ON CONVENTIONAL AND INNOVATIVE (RESISTANT) VARIETIES, YEAR 2014, 2015 and 2016

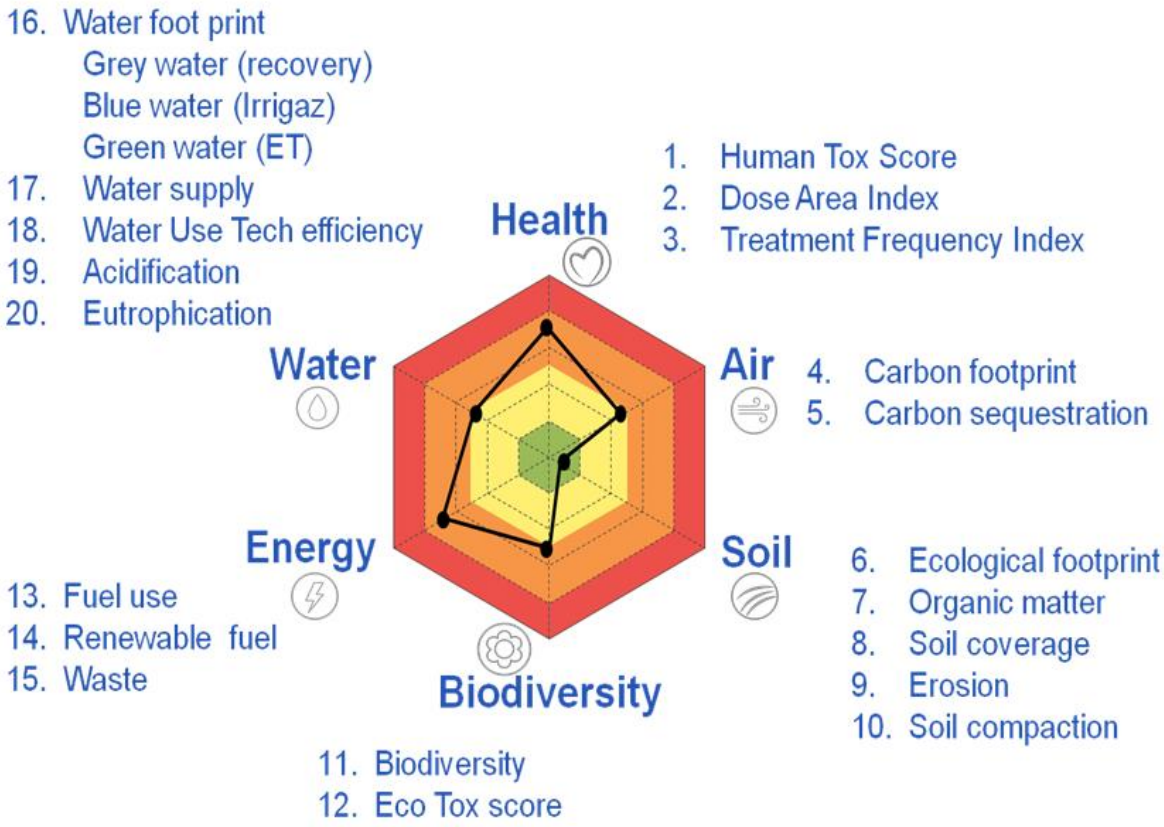






Spraying on **resistant varieties** has always been **substantially less** than spraying on conventional varieties.

Field data were recorded in an excel file (input and cost analysis) provided by Horta for the environmental, economic and human-health impact assessment of the common (conventional varieties) and innovative (resistant varieties) practices.

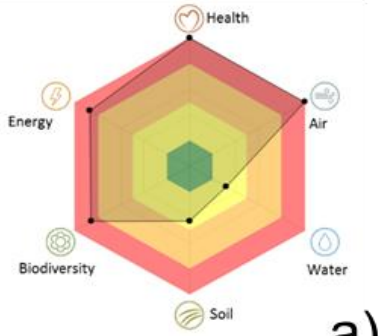


EVALUATION OF CONVENTIONAL AND INNOVATIVE PRACTICES IMPACT ON ENVIRONMENTAL AND HUMAN HEALTH (yousustain.net, patented by HORTA)

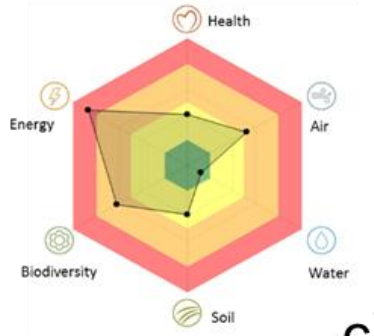
Conventional variety **Merlot** or **Montepulciano**

Resistant variety **Soreli**

Site 1: Fossalon (north-coastal), **conventional treatment protocol**

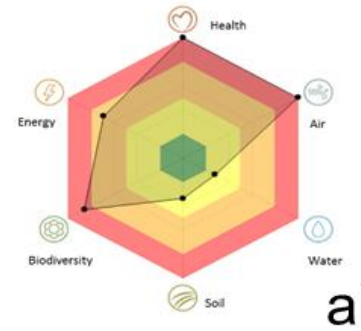


a)



c)

Site 2: Rauscedo (north-mainland), **conventional treatment protocol**



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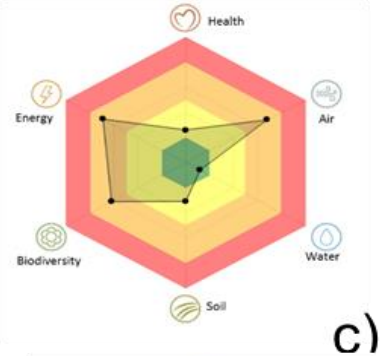
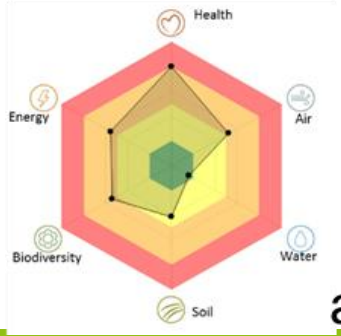
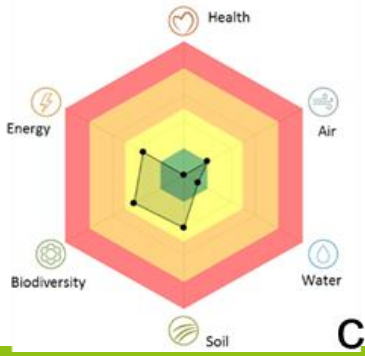


c)

Site 3: Ripa Teatina (central), **organic treatment protocol**



a)



c)

AGRONOMIC DATA: PLANT PRODUCTIVITY

PLANT PRODUCTIVITY, site 1: north-coastal (Fossalon)								
VARIETY	2014		2015		2016		MEAN	STATISTICAL SIGNIFICANCE
	Kg/plant	class	Kg/plant	class	Kg/plant	class		
30-080	0,96	c	2,97	a	1,8	b	1,91	***
31-103	2,17	b	3,5	a	3,3	a	2,99	***
31-120	1,55	b	2,88	a	2,96	a	2,46	***
34-111	2,48	c	2,69	b	3,22	a	2,80	***
34-113	3,76	b	4,64	a	4,67	a	4,36	***
76-026	2,91	b	3,97	a	3,86	a	3,58	***
MERLOT	4,1	a	3,74	b	3,75	b	3,86	***
TOCAI FRIULANO	2,96	b	3,05	ab	3,22	a	3,08	**
SAUVIGNON	n.d.	n.d.	3,71	a	3,51	b	3,61	*

lower productivity

PLANT PRODUCTIVITY, site 2: north-mainland (Rauscedo)								
VARIETY	2014*		2015		2016		MEAN	STATISTICAL SIGNIFICANCE
	Kg/plant	class	Kg/plant	class	Kg/plant	class		
31-120	n.d	n.d	1,68	b	2,51	a	2,10	***
34-111	n.d	n.d	2,53	b	3,04	a	2,79	***
34-113	n.d	n.d	3,56	a	3,68	a	3,62	ns
76-026	n.d	n.d	3,64	a	3,45	a	3,55	ns
MERLOT	n.d	n.d	3,35	a	3,51	a	3,43	ns
TOCAI FRIULANO	n.d	n.d	3,25	b	3,69	a	3,47	***
SAUVIGNON	n.d	n.d	3,3	a	3,29	a	3,30	ns

* data not available, unfavorable weather conditions

PLANT PRODUCTIVITY, site 3: central (Ripa teatina)	
VARIETY	2016
31-103	1,63
31-120	1,61
34-111	1,96
34-113	2,09
76-026	2,61
MONTEPULCIANO	2,71

* 2014 was characterized by unfavorable weather conditions conducive to botrytis and sour rot that compromised plant productivity and wine quality.

* Plant productivity generally increased in 2015 and stabilized in 2016,

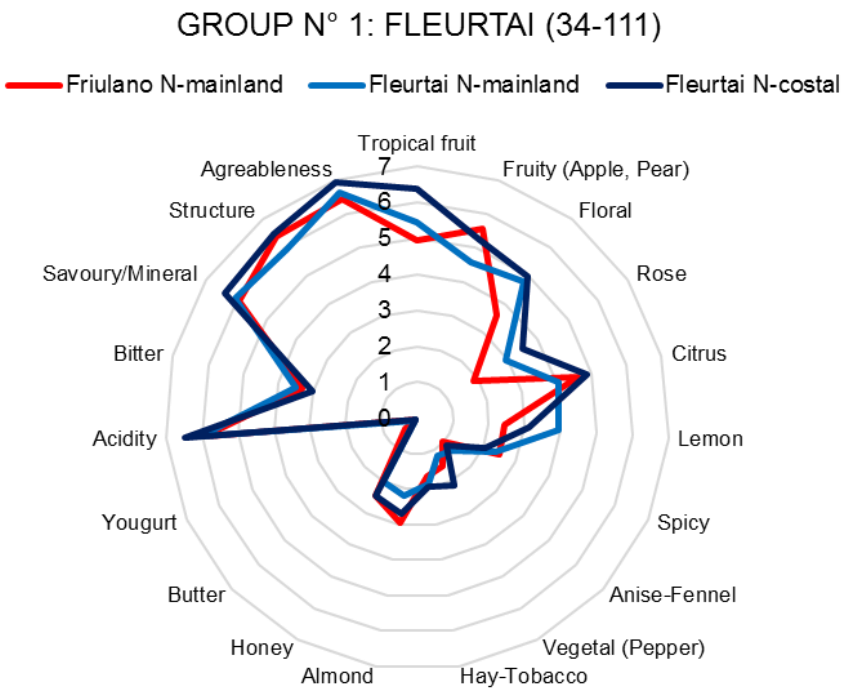
* **Yield of resistant varieties was comparable to conventional varieties.**

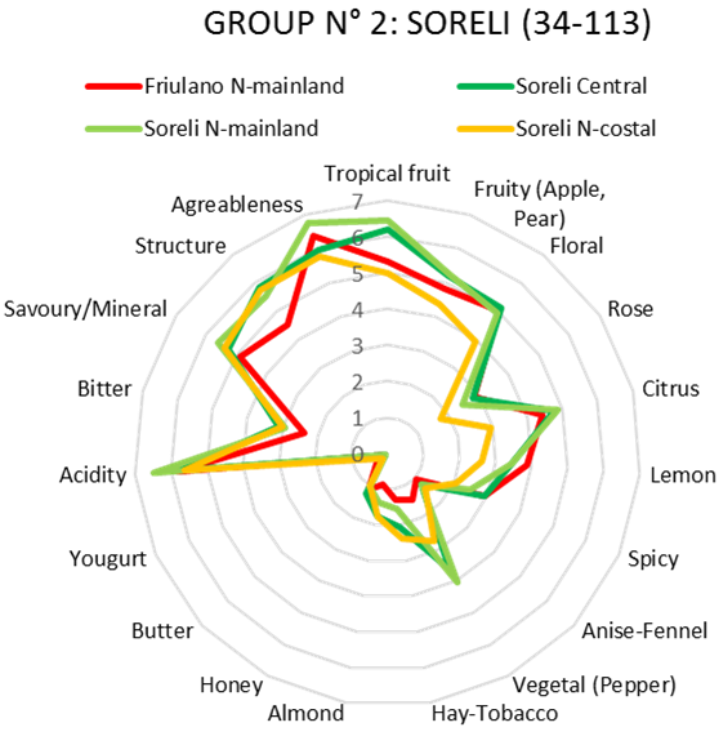
TASTING SESSION

- Wines were **blind tested** in groups of samples, including the wines from the resistant variety and its parental variety.
- The **wine** from the **parental variety** was **included in more groups**, in order to normalize within-group and between-groups evaluation scores.

WINE	PARENTALS	SITE	GROUP
Fleurtai (34-111)	Tocai friulano x 20-3	north-mainland	1
Friulano		north-mainland	
Fleurtai (34-111)	Tocai friulano x 20-3	north-costal	
Friulano		north-mainland	2
Soreli (34-113)	Tocai friulano x 20-3	central	
Soreli (34-113)	Tocai friulano x 20-3	north-mainland	
Soreli (34-113)	Tocai friulano x 20-3	north-costal	
Sauvignon kretos (76-026)	Sauvignon x 20-3	central	3
Sauvignon kretos (76-026)	Sauvignon x 20-3	north-mainland	
Sauvignon		north-mainland	
Sauvignon kretos (76-026)	Sauvignon x 20-3	north-costal	
Sauvignon		north-costal	5
30-080	Sauvignon x 20-3	north-costal	
31-120	Merlot x 20-3	central	7
Merlot		north-costal	
31-120	Merlot x 20-3	north-mainland	
31-120	Merlot x 20-3	north-costal	
merlot		north-costal	8
31-103	Merlot x 20-3	central	
31-103	Merlot x 20-3	north-mainland	

TASTING SESSION

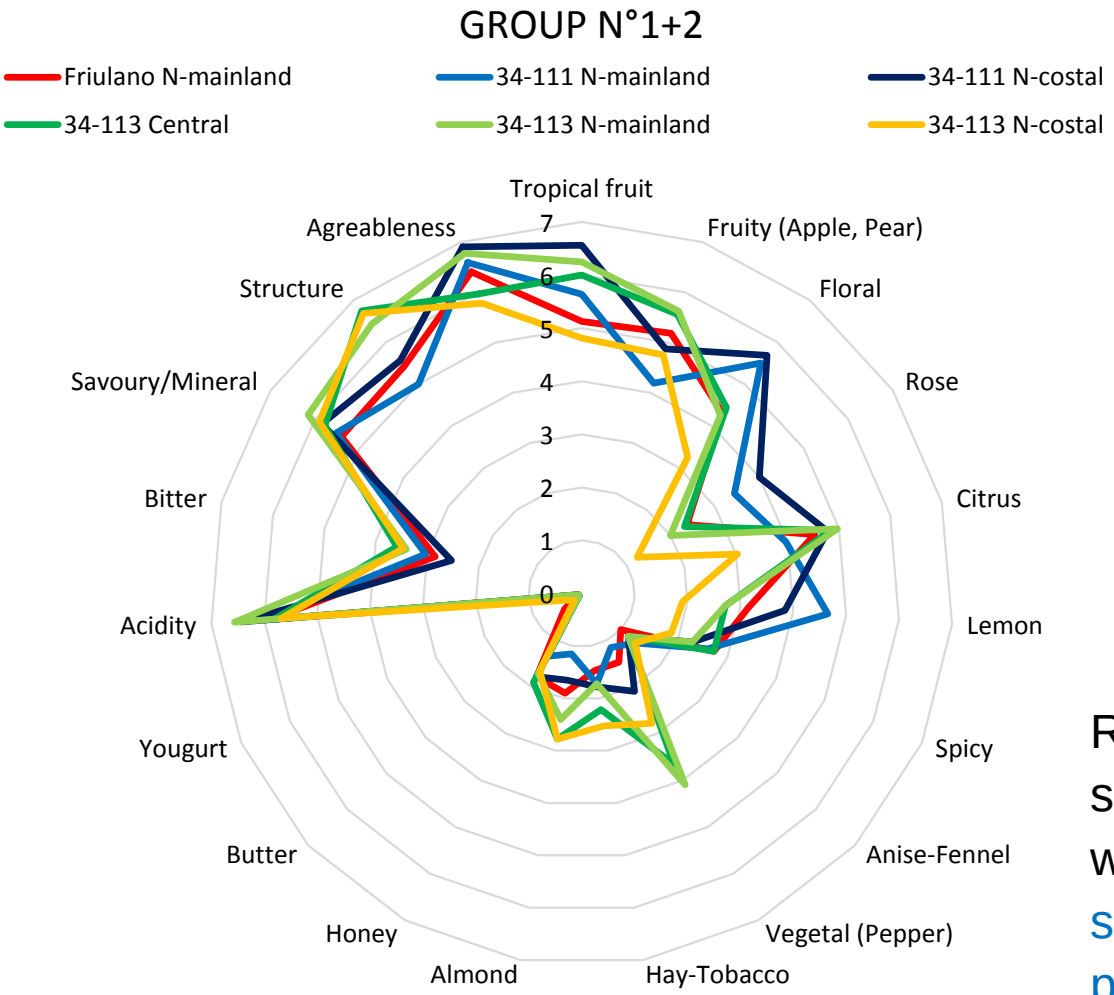




Fleurtai : good ampleness, fruity and floral aromas, fresh lemon hints, appreciated in both samples from north-mainland and north-coastal sites, Rauscedo and Fossalon.

Soreli: aromatic amplitude, structure and minerality above average in all tasted samples. Pronounced almond and pear notes resembled those of the parental variety, Tocai friulano.

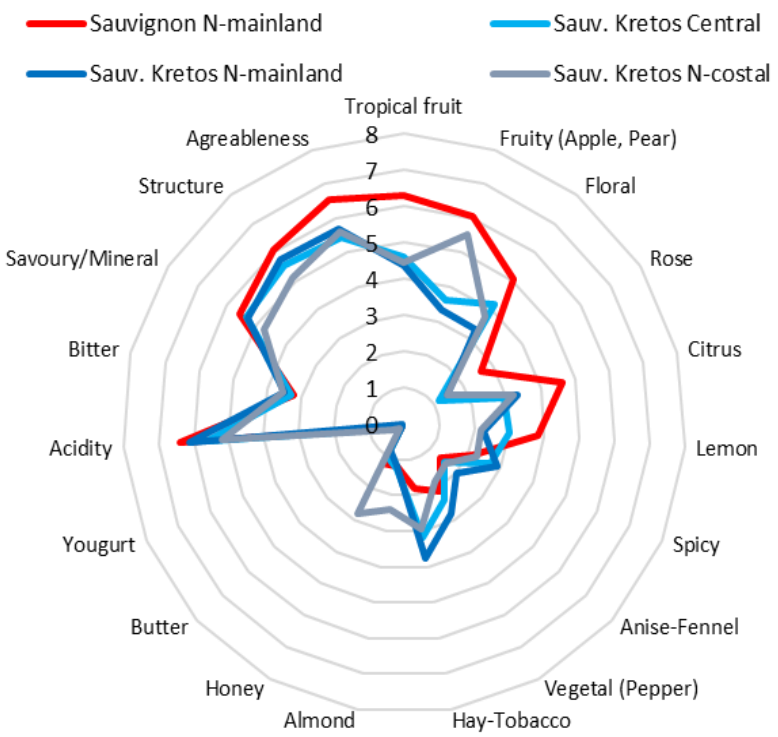
TASTING SESSION



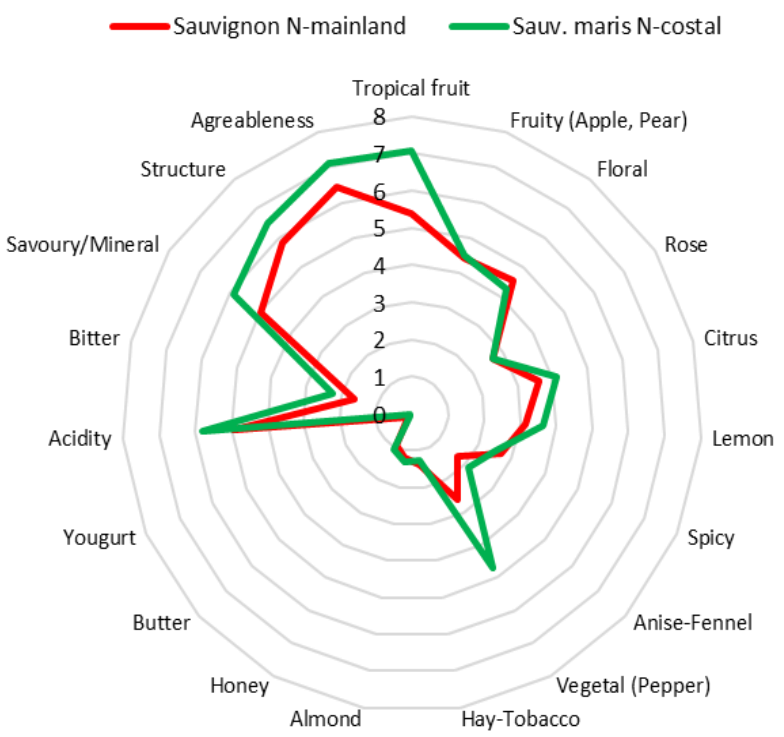
Resistant varieties, having the same noble parental variety, were grouped toghether and standardized on the same parental-average.

TASTING SESSION

SAUVIGNON KRETOS (76-026)
GROUP N° 3



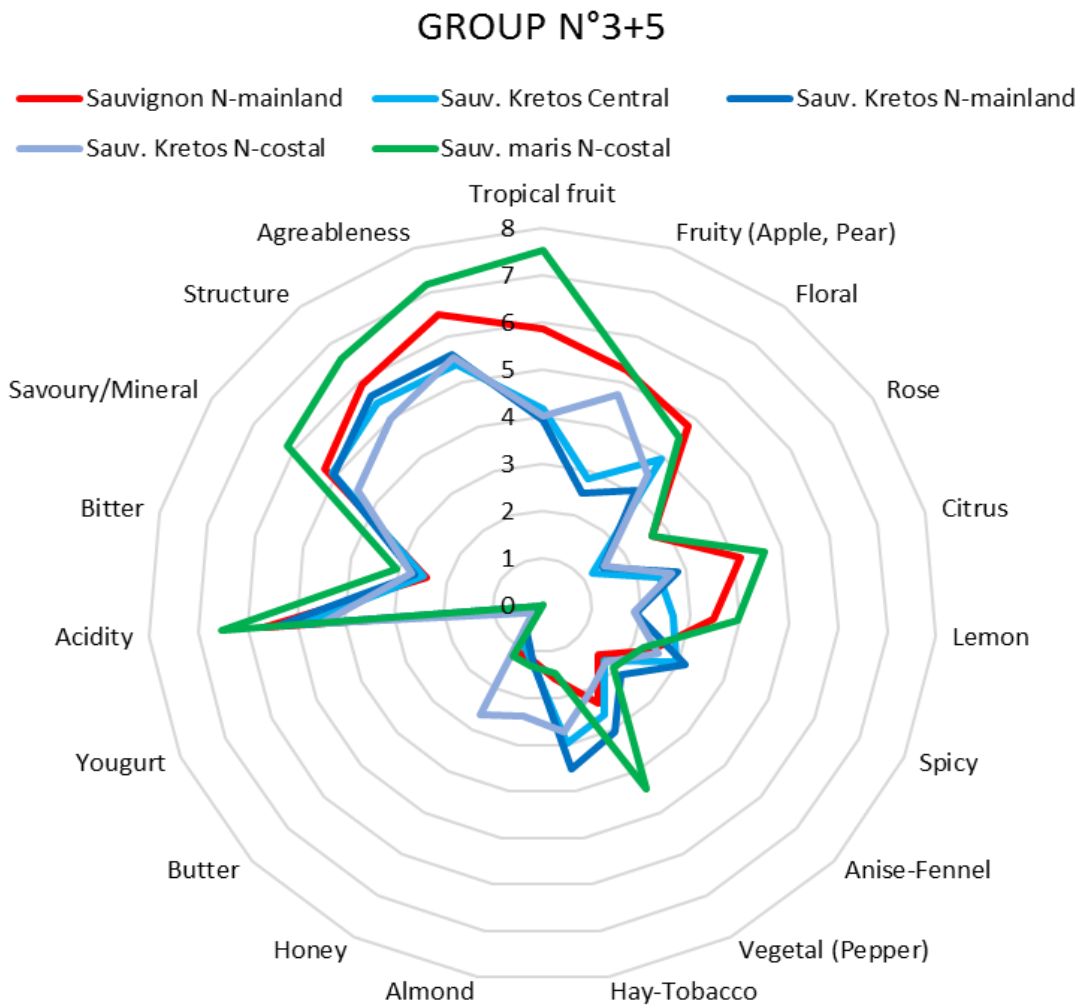
SAUVIGNON MARIS (30-080)
GROUP N° 5



Sauvignon Kretos: medium intensity with peaks towards spicy, tobacco and vegetal aromas. Structure of medium intensity.

Sauvignon Maris (30-080): scored higher than Sauvignon for most aromas.

TASTING SESSION



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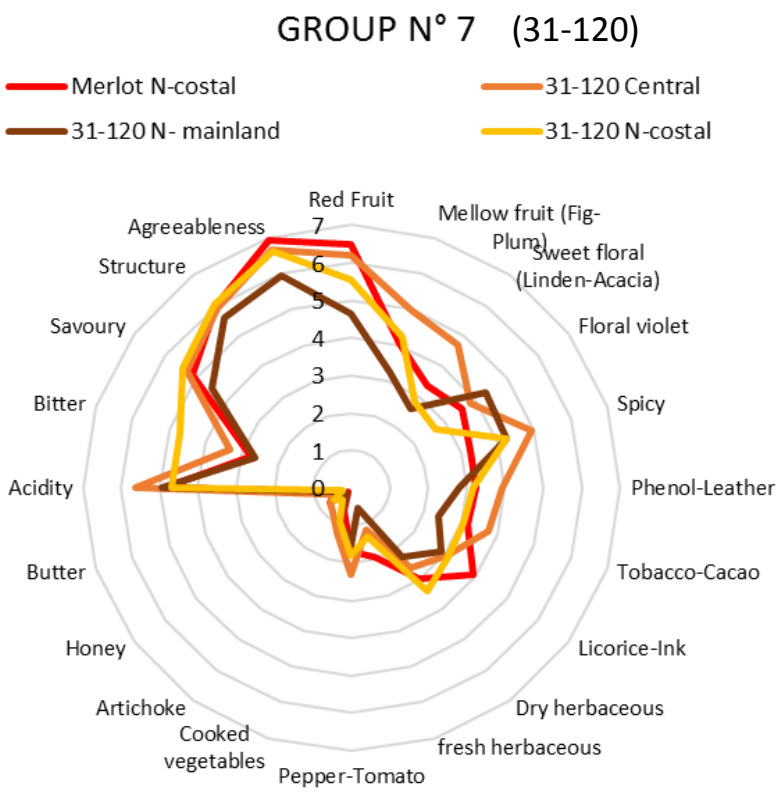
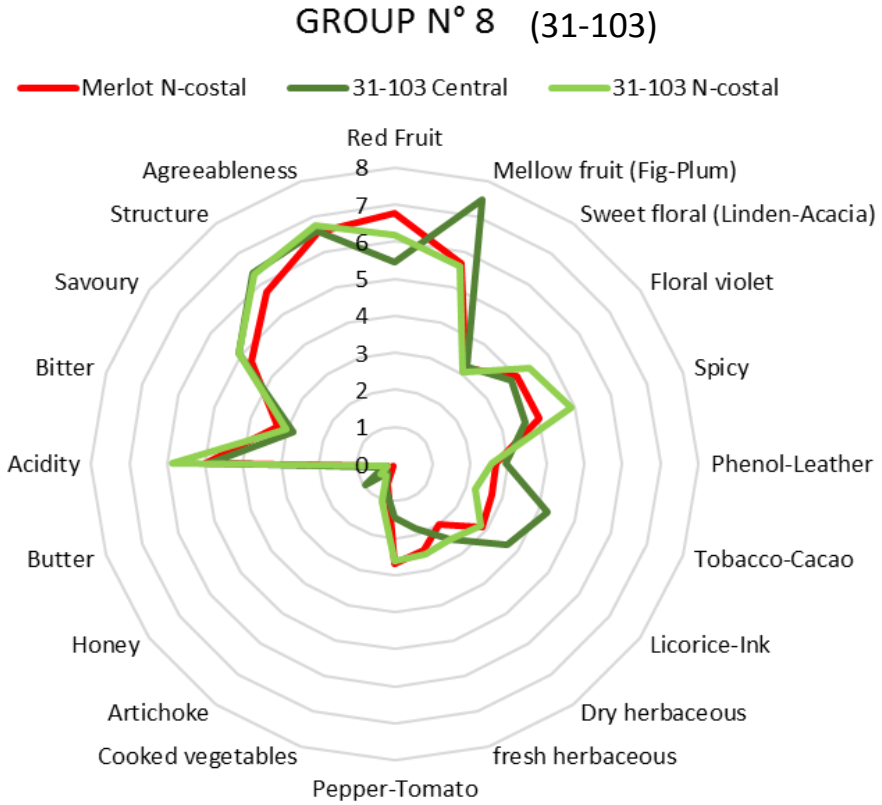
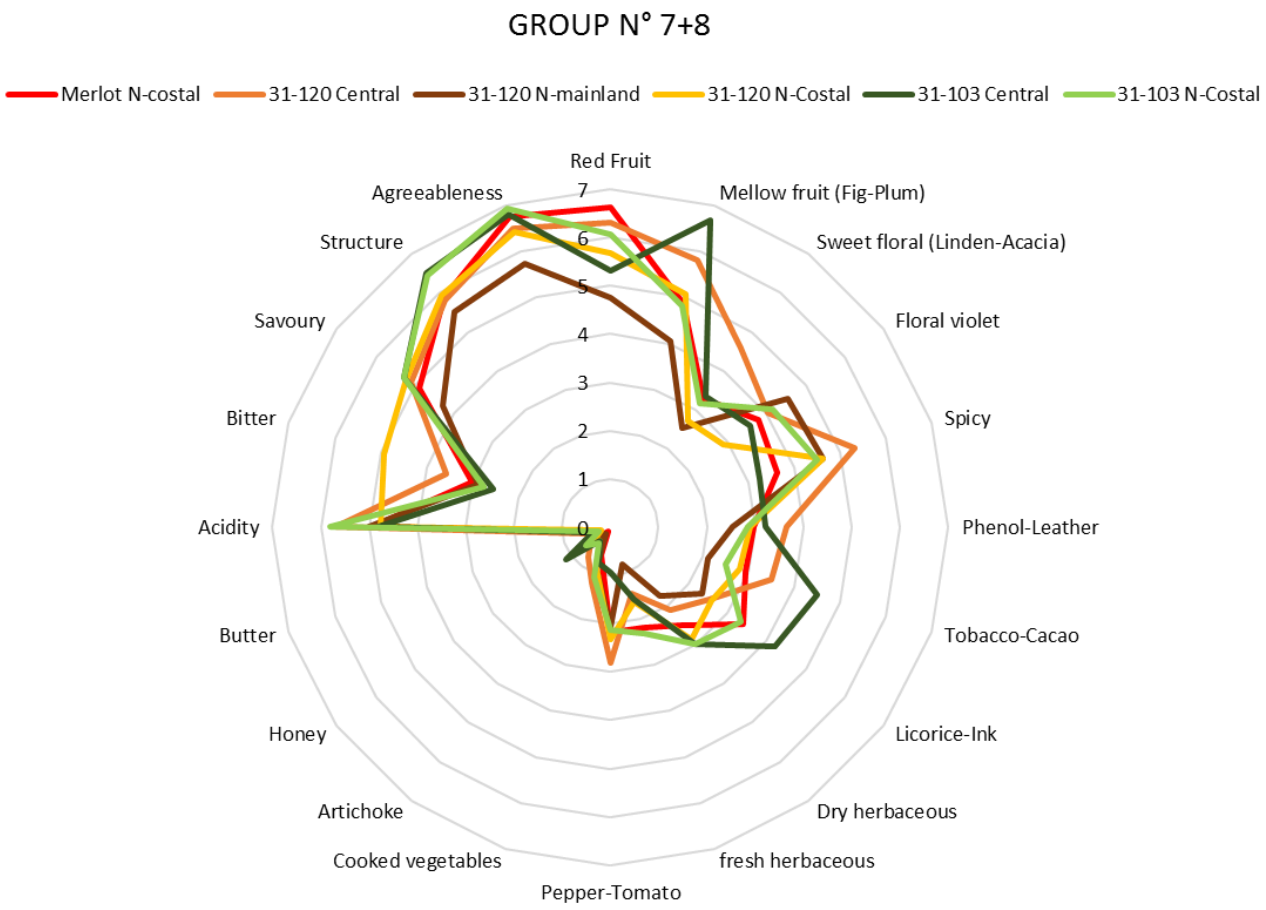




31-120 and **31-103:** deeply influenced by the **site of origin** of the grapes: more fresh aromas of floral violet when cultivated in northern latitude, and sweeter and mellow hints when cultivated in warmer climates of Central Italy.

The **bouquet of 31-103** resembled that of **Merlot**, cultivated in the same north-coastal site.

TASTING SESSION



SUMMARY

- **Resistant varieties** displayed **good-to-excellent** foliar and bunch **resistance** to **downy mildew**, in the field conditions of the three experimental sites.

- **Powdery mildew resistance** was **adequate** for the investigated sites. Damage of powdery mildew on bunches was scored on Sauvignon Kretos (76-026) under highly conductive conditions.

- **Resistant varieties** required **less treatments** than conventional varieties (2-3 treatments on resistant varieties, 12 to 16 treatments, on average, with peaks of 22 treatments in 2014 for conventional varieties).

- **Environmental** and **human toxicity score**, **economic** and **environmental impact** are **substantially lower** for resistant varieties.

- **Yield** of resistant varieties is **comparable to conventional varieties**, **stable** over the years (except for Sauvignon Maris that requires cross-pollination and benefits from good weather conditions during blooming).

- Wine from resistant varieties….you will judge personally during the tasting session!