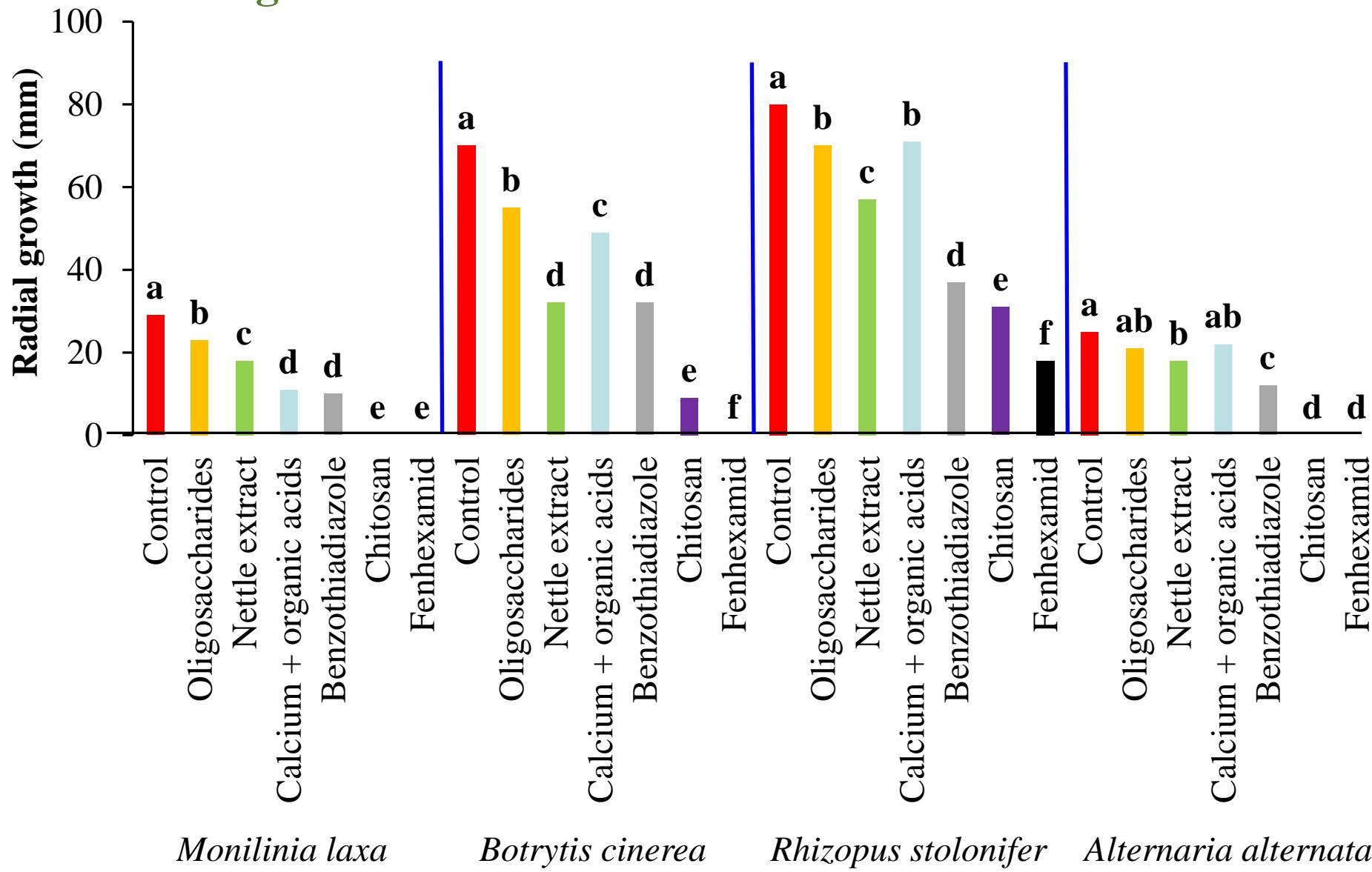


Radial mycelial growth of fungal colonies of decay causing fungi on PDA amended with resistance inducers



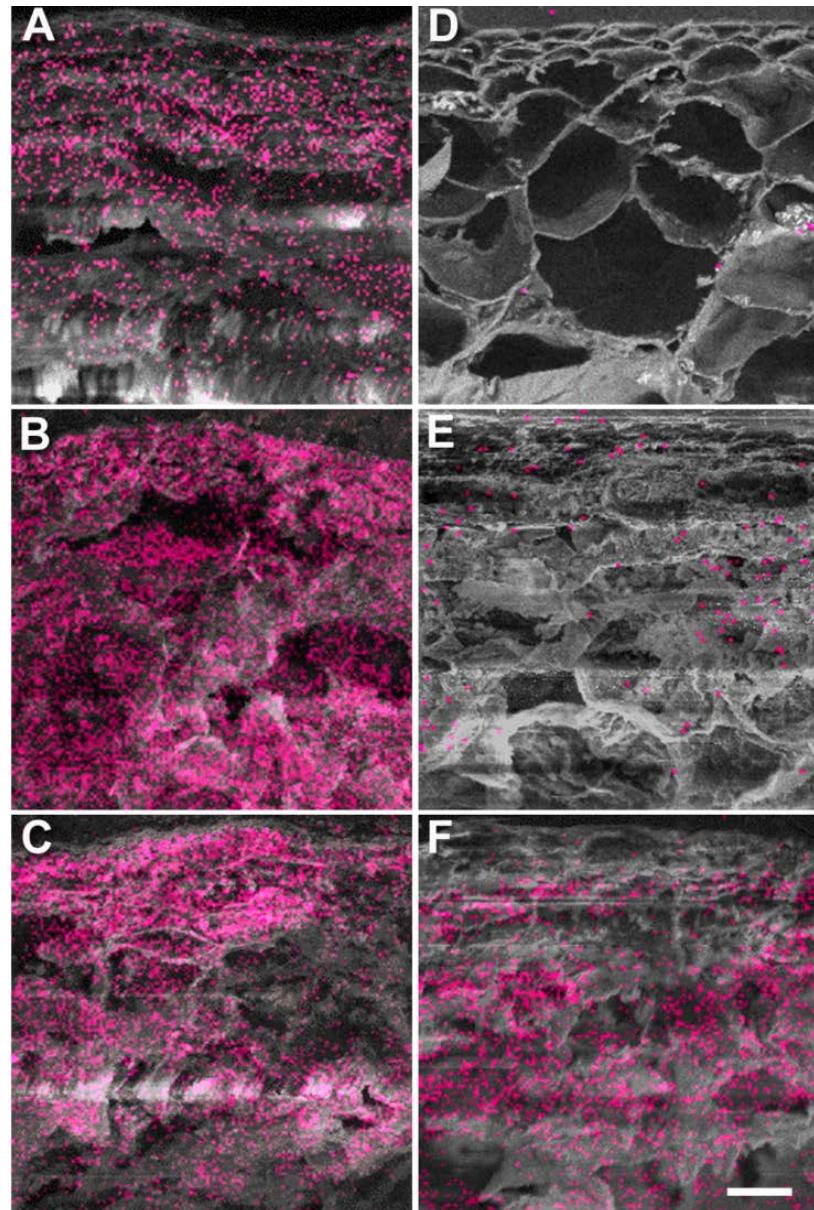
INDUCTION OF RESISTANCE

Location and content of hydrogen peroxide in mature ‘Thompson Seedless’ grape berry tissue as shown by scanning electron microscope

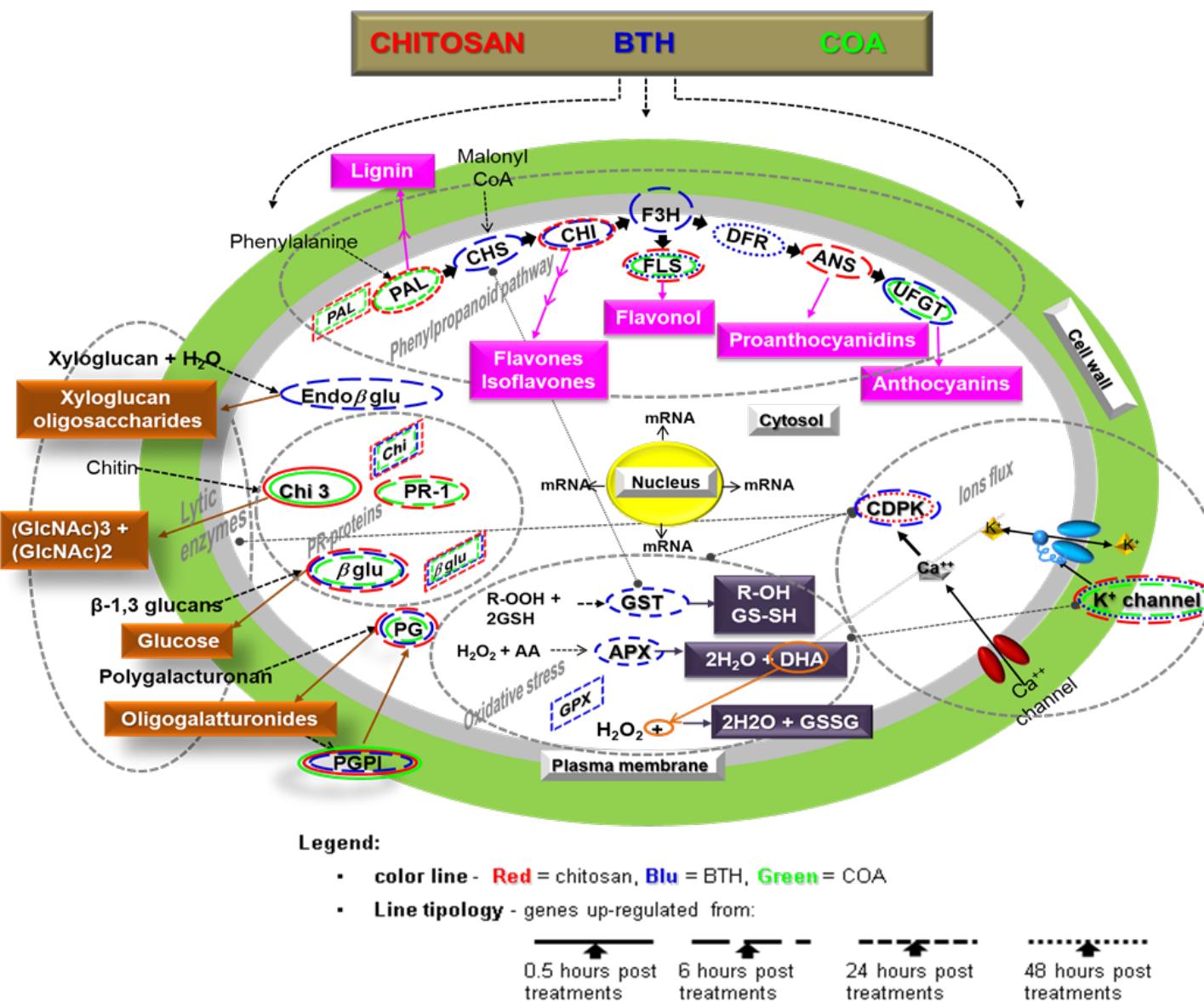
The berries were treated with:

- A – Water (control)
- B – K sorbate
- C – Fungicides
- D – Chitosan-A (OII-YS)
- E – Chitosan-B (Chito Plant)
- F – Chitosan-C (Armour-Zen)

The reaction product of hydrogen peroxide and cerium chloride is cerium hydroxide, that is highlighted by the pink pixels



The resistance inducers triggered the expression of a large number of genes that lead to the physiological events involved in plant defense



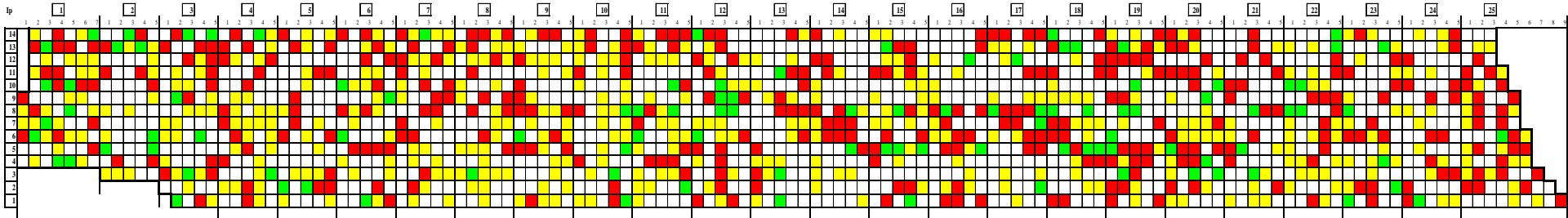
What is Bois noir?

It is the most widespread phytoplasma disease of grapevine in Europe and Mediterranean area



Vineyard cv Chardonnay, Montalto Marche (AP), Central Italy

1741 plants



- █ Symptomatic plants in 2009 (24%)
- █ Recovered plants in 2010 (6%)
- █ New symptomatic plants in 2010 (20%)
- █ Symptomless plants in 2009-2010

Total symptomatic plants in 2010: 38%!

Effects of Bois noir on net photosynthesis, stomatal conductance and transpiration rate in *Vitis vinifera* cv. Chardonnay

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Department of Agricultural, Food and Environmental Sci

Table 1. Productive parameters of the HG ($n = 3$) are mean \pm se. HG4, asymptomatic grapevine in July showed BN symptoms in the present season.

Parameter	HG	
Yield (g plant $^{-1}$)	4960.0 \pm 1313.4	145
Bunches/plant (n)	24.3 \pm 4.5	1
Dried bunches/plant (n)	0	
Dehydrated bunches/plant (n)	0	
Asymptomatic bunch weight (g)	190.8 \pm 18.0	20
Symptomatic bunch weight (g)	–	7
Asymptomatic berry weight (g)	1.63 \pm 0.0	1
Symptomatic berry weight (g)	–	

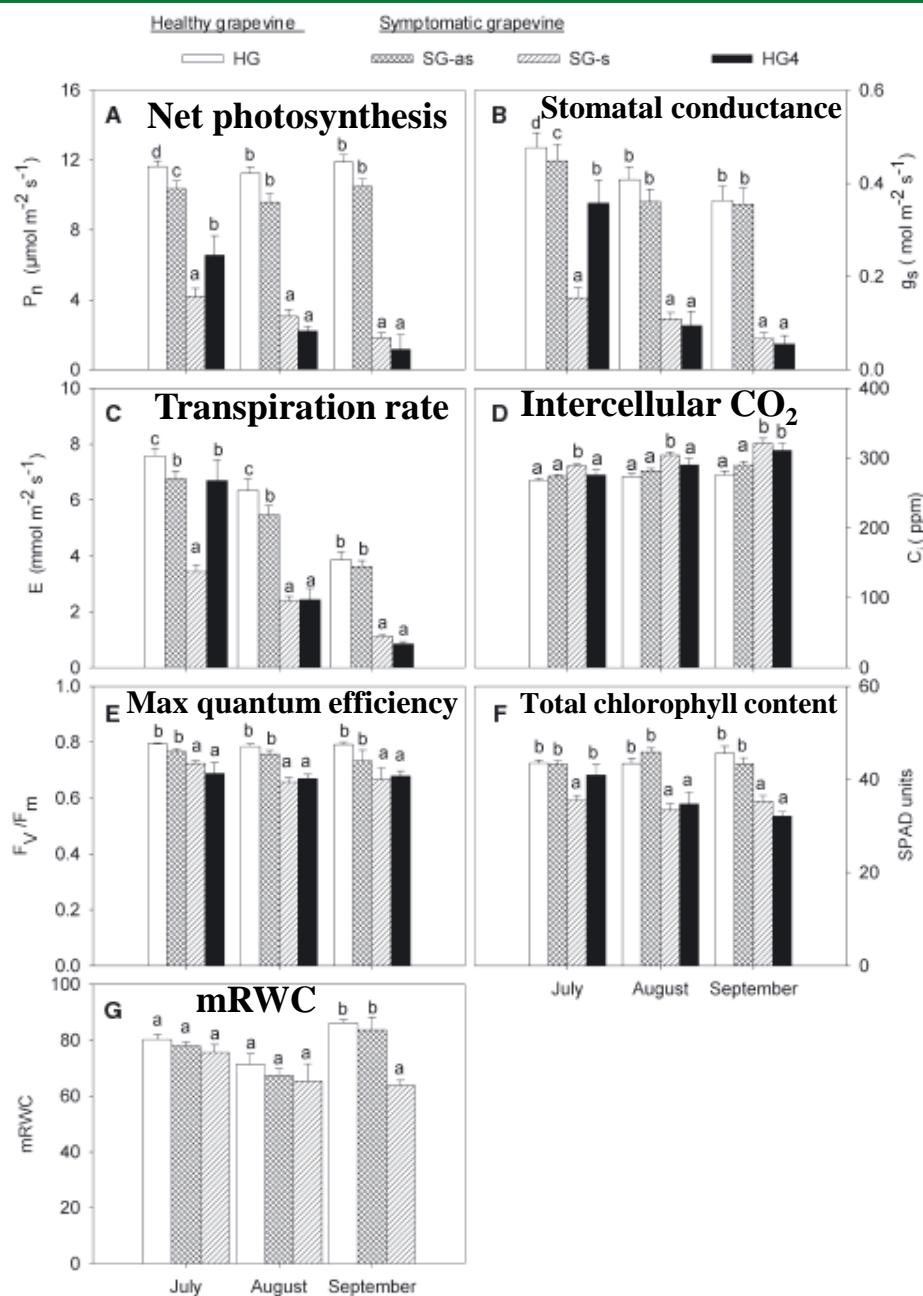


Fig. 3. Changes through the season from July to September in: (A) net photosynthesis (P_n), (B) stomatal conductance (g_s), (C) transpiration rate (E), (D) intercellular CO_2 concentration (C_i), (E) the maximum quantum efficiency (F_V/F_m), (F) the total chlorophyll (chl a + b) content (SPAD units) and (G) the mRWC. Mean (\pm se) data are shown for HGs ($n = 3$), SGs ($n = 4$) and for HG4 plant four leaves ($n = 4$). Means in the same month marked with different letter(s) are significantly different at $P < 0.05$.

Treatments

Commercial formulation	Company	Active ingredient	Preharvest interval (d)	Spacing of treatments	Application rate (kg/ha or l/ha)	Plant Protection Product/ Use on grapevine
Aliette	Bayer, D	Phosetyl-Al	40	21	2.5-3.0	yes/yes
Kendal	Valagro, Atessa (CH), I	Glutathion + oligosaccharines	-	5-10	2.5-4.0	no/yes*
Chito Plant	Chipro, Brema, D	Chitosan	-	n.d.	0.05-5.0	no/yes*
Bion	Syngenta, CH	Acibenzolar-S-methyl (benzothiadiazole)	-	7-14	0.15-0.2	yes/no
Olivis	Agrisystem, Lamezia Terme (CZ), I	Glutathion + oligosaccharines	-	7-10	3-4.0	no/yes*
Control						

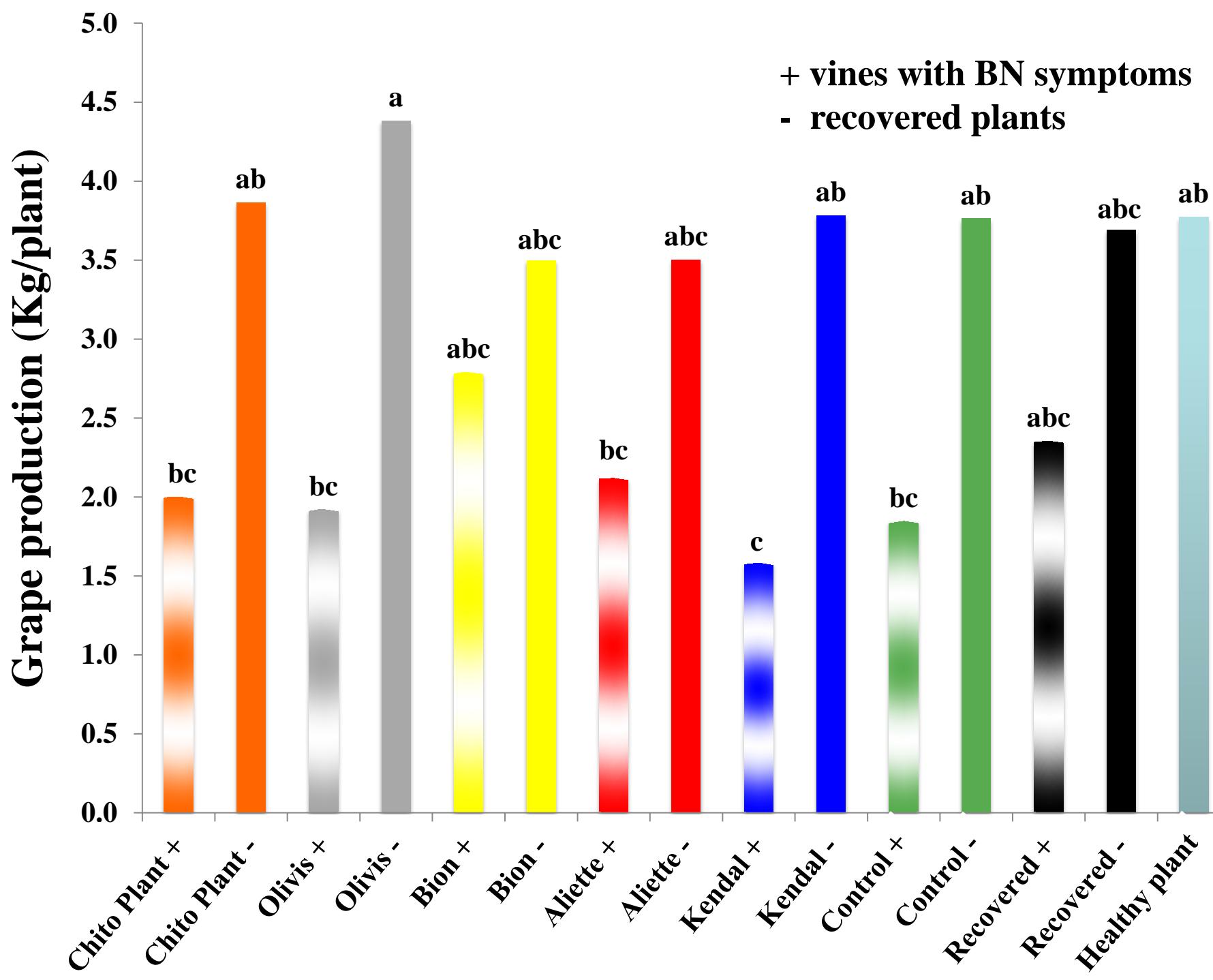
*fertiliser that can promote plant defenses

Rank analysis

Results

Treatment	Recovered plants (%)				Average
	2007	2008	2009	2010	
Aliette	65.7 ab	28.6 bc	33.3 b	20.0 b	36.9±10.0
Kendal	71.4 a	57.1 a	58.4 a	28.6 b	53.9±9.0
Chito Plant	48.6 bc	31.2 bc	33.3 b	27.3 b	35.1±4.7
Bion	79.5 a	53.3 ab	41.7 ab	53.4 a	56.7±7.8
Olivis	74.5 a	50.0 ab	50.0 a	28.6 b	50.8±9.4
Control	37.5 c	23.1 c	8.3 c	36.8 ab	26.4±8.9

Treatment	Year				Sum of ranks
	2007	2008	2009	2010	
Aliette	4	5	4	6	19
Kendal	3	1	1	3	8
Chito Plant	5	4	4	5	18
Bion	1	2	3	1	7
Olivis	2	3	2	3	10
Control	6	6	6	2	20



Evaluation of the characteristics of vineyard pruning residues for energy applications: effect of different copper-based treatments

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Table 2. Comparison between copper distributed and copper registered (mean values) in pruning wood and soil.

Thesis	Copper absolute value (kg/ha)	Copper concentration in the vine pruning (mg/kg)	Copper concentration in the soil (mg/kg)
Bordeaux mixture	11.0	19.2	113.4
Copper hydroxide	5.8	10.6	102.8
Laminarin + copper hydroxide/copper oxide	1.8	8.5	81.0
Farm application	4.3	10.9	86.3
Control	-	7.0	88.3

Chitosan Oligomers and Copper Sulfate Induce Grapevine Defense Reactions and Resistance to Gray Mold and Downy Mildew

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ABSTRACT

Aziz, A., Trotel-Aziz, P., Dhuicq, L., Jeandet, P., Couderchet, M., and Vernet, G. 2006. Chitosan oligomers and copper sulfate induce grapevine defense reactions and resistance to gray mold and downy mildew. *Phytopathology* 96:1188-1194.

Chitosan (CHN), a deacetylated derivative of chitin, was shown to be efficient in promoting plant defense reactions. CHN oligomers of different molecular weight (MW) and degree of acetylation (DA) triggered an accumulation of phytoalexins, *trans*- and *cis*-resveratrol and their derivatives ϵ -viniferin and piceid, in grapevine leaves. Highest phytoalexin production was achieved within 48 h of incubation with CHN at 200 μ g/ml with an MW of 1,500 and a DA of 20% (CHN1.5/20), while oligomers

with greater MW were less efficient, indicating that a specific MW threshold could be required for phytoalexin response. Treatment of grapevine leaves by highly active CHN1.5/20 also led to marked induction of chitinase and β -1,3-glucanase activities. CHN1.5/20 applied together with copper sulfate (CuSO_4) strongly induced phytoalexin accumulation. CuSO_4 alone, especially at low concentrations also elicited a substantial production of phytoalexins in grapevine leaves. Evidence is also provided that CHN1.5/20 significantly reduced the infection of grapevine leaves by *Botrytis cinerea* and *Plasmopara viticola*, and in combination with CuSO_4 conferred protection against both pathogens.

Additional keywords: elicitor, *Vitis vinifera*.