

“Biocontrol” Products: Of relative efficiency in combating *botrytis*

>>> *Botrytis* effects the yield and the quality of grape musts. To protect against these damaging effects, winegrowers target their combat against this disease with the application of phytosanitary products and prophylactic interventions. In an oceanic climate, one or two costly annual treatments are commonly applied using products that are both dangerous to the environment and to the health of the machine operator. The biocontrol products represent an interesting alternative to the latter products, but as this study finds, they are neither as effective nor as efficient as classical fungicides. <<<

Botrytis, or grey rot, brings about a reduction of yield and even more importantly affects the quality of the grape musts¹. The loss arising may be large as was observed during the 2013 vintage where the weather conditions at the end of the summer offered an ideal environment for the development and spread of the fungus². The development of the disease is significantly influenced by diverse biotic factors (grape variety, nitrogen-based fertilization, soil tilling, suckering, de-foliation) or abiotic factors (climate). The fight against *botrytis* is above all based on prophylaxis but one to two treatments are usually applied on the bunches. Hence, in 2010, two thirds of the vineyard surfaces in Bordeaux were subject to a specific protection with, on average 1.5 treatments³. Yet synthetic plant health care products against *botrytis* do not have an unharmed effect on the environment or on the machine operator. Furthermore, these products are costly and are susceptible to manifesting problems of plant resistance and/or residues in the wine. To address this problem, so called “biocontrol”⁴ products against *botrytis* have been marketed in France since 2010. In this respect, there exist antagonistic bacteria (*Bacillus subtilis*) and antagonistic yeast-based products (*Aureobasidium pullulans*) or mineral-based fungicides (potassium bicarbonate)⁵. The efficiency of these products was found to be both variable and partial by research and development organizations⁶. With an ongoing concern in diminishing the use of phytosanitary products, the question arises regarding the use of these “biocontrol” products to effectively manage this disease.

■ A new « biocontrol » product touted to be equally as effective as the traditionally used reference fungicides

In 2014, several Bordeaux wine estates were approached to use this product against *botrytis* where the efficiency was “said to be” similar to conventional fungicide products but with a “biocontrol” product profile. This product was never officially approved in France as a phytosanitary product³. It is classified as a foliar fertilizer composed of calcium and different macro and trace elements including magnesium and boron (CaO+MgO+B). According to the manufacturer, the product combats *botrytis* via the calcium and the magnesium that facilitates the thickening of the grape skin and the boron that facilitates the plant’s calcium absorption. In a general demarche of reducing synthetic inputs and their TFI (Treatment Frequency Index)⁶ that they



Figure 1. *Botrytis* attack on the bunch ©Vitinov.

began several years ago, these viticultural properties in the Médoc region decided to more closely study the efficiency of this product. The study was timely after the losses incurred during the 2013 vintage. In this way, this collective study was undertaken in 2015 on 16 trial parcels, selected from 10 different wine properties divided into 2 black grape varieties: 11 parcels of Cabernet-Sauvignon and 5 parcels of Merlot. The same treatment modalities were effectuated on the entirety of the vineyard parcel network; that is 4 to 5 applications with a dose of 4 kg/ha covering the growing periods from the bunch separation phase until the harvest, following the manufacturers recommendations. Each trial parcel equally included a non-treated control against *botrytis* (NTC) so as to evaluate the disease pressure of the year as well as a modality with the application of a synthetic fungicide called “the reference” used by each vineyard property depending on their habitual uses. Certain parcels included a supplementary modality composed of potassium bicarbonate, alone/or associated with a foliar fertilizer. On each modality the counting of the frequency and intensity of the *botrytis* on the bunch was effectuated by the same person in the entirety of the parcel network.

■ Disappointing results

The 2015 vintage year was not favorable for the development and spread of the fungus⁷. In effect, the flowering and berry-set were early under warm and relatively dry weather conditions, followed by a hot and dry month of July with a rather dry ripening period without excessive heat. Despite these conditions, the *botrytis* attack frequency reached 20 % on average on the NTC, which is sufficient for evaluating the efficiency of the products. In general, there was no observable difference of the attack frequency on the bunches between the parcels treated with foliar fertilizer and the NTCs (Figure 2). Likewise, there was no significant measurable difference between the NTC modality and the potassium bicarbonate treated modality. This latter modality was absent on the entirety of the vineyard network and this result should be relativized. Significantly lower attack frequency was noted on the

modality treated with traditional reference anti-*botrytis* fungicide as compared to the biocontrol modalities. Only the referenced anti-*botrytis* presented significantly lower attack frequency by the fungus as compared to the NTC and at the same time only one treatment had been applied. However, the attack frequency of this modality had still reached 15 % of the bunches. Compared to the NTC, this difference was more marked on the Merlot grape variety than on the Cabernet-Sauvignon. We note that the combination of the 2 "biocontrol" products (potassium bicarbonate and the foliar fertilizer) presented an attack frequency that was far superior to the NTC, which is surprising to say the least.

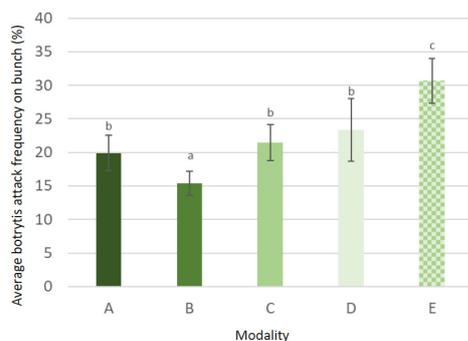


Figure 2. % of average bunch attack frequency on 16 parcels for the different modalities (A = Non treated control, B = Conventional referenced anti-*botrytis* (one treatment only during flowering or at bunch closure), C = foliar fertilizer / CaO+MgO+B (depending on the recommendations of the prescriber; 4 to 5 applications with a dose of 4 kg/ha from the bunch separation phase to the harvest), D = potassium bicarbonate (2 treatments; at flowering and at veraison (color change), E = modalities C + D).

In terms of impact, with attack frequencies being equal and for a lower attack intensity, the use of a less efficient type of "biocontrol" product could be an interesting complement to prophylaxis. Effectively it is preferable to have very few berries per bunch affected than a *botrytis* outbreak that is broadly spread.

Figure 3 presents the results obtained for the intensity of *botrytis* attacks. As a result of weather conditions that were unfavorable for the fungus propagation in August and September⁷, the measured intensities remained relatively low for all modalities. Nevertheless, the lowest intensities were obtained on the modalities treated with the potassium bicarbonate only. Only the intensity of this modality was significantly different from the NTC. Therefore, this "biocontrol" product could eventually present an interest in combating *botrytis* during a less serious outbreak. On the contrary, no difference was observed between the vines treated with foliar fertilizer only, and the NTC. The treatment with the reference anti-*botrytis* product permitted a significant reduction of the attack intensity compared to the NTC as opposed to the combination of the fertilizer and the biocontrol product where we observed an increased intensity of symptoms on the bunch. The results were similar between parcels of two different grape varieties and the most significant intensities were always observed on the most vigorous parcels.

■ What to retain?

No efficiency of the foliar fertilizer (CaO+MgO+B) was observed either regarding the frequency or the attack intensity of the grey rot. Considering these inconclusive results, the winegrowers decided not to continue with the experimentation in other vintages. It is, therefore, difficult to definitively conclude with only one year of trials since

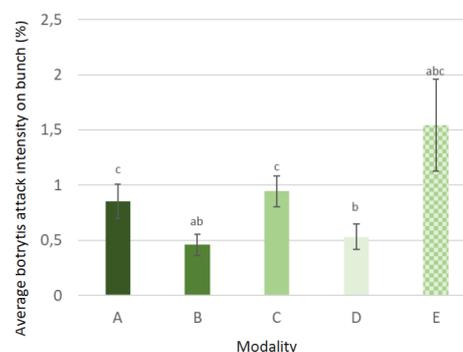


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the epidemic profile of the disease is very variable from one year to the next⁵. However, given that the results obtained were during a year where the risk of disease outbreak and development was relatively low, it shows that this product does not live up to the praise given to it by the manufacturer. The approval and certification of phytosanitary products for a given use is, therefore, a guaranty of minimal efficiency for the winegrowers.

It must be noted however, that the use of conventional anti-*botrytis* products in this trial, only modestly reduced the attacks of this fungus, confirming that prophylaxis remains the most efficient means to fight the damaging impacts of *botrytis*. The treatment with the anti-*botrytis* product, whether conventional or "biocontrol", will only improve the results obtained by prophylaxis methods (good vigor management, the micro-climate of the bunch, the attacks of grape worms etc.) This was outlined during this experiment, notably with the confirmation of the link between the vigor and the intensity of the *botrytis* attack¹. The proper vigor management in the vine parcels is, therefore, a major contributor in the reduction of the use of anti-*botrytis* products. ■

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¹ Ky, I., Lorrain, B., Jourdes, M., Pasquier, G., Fermaud, M., Gény, L., Rey, P., Doneche, B. And Teissedre, P. (2012), Assessment of grey mould (*Botrytis cinerea*) impact on phenolic and sensory quality of Bordeaux grapes, musts and wines for two consecutive vintages. *Australian Journal of Grape and Wine Research*, 18: 215-226. <https://doi.org/10.1111/j.1755-0238.2012.00191.x>

² Agreste (2010). <http://agreste.agriculture.gouv.fr/recensement-agricole-2010/>

³ <https://ephy.anses.fr/>

⁴ A set of cultural protection methods based on the use of living organisms or of natural substances; A category specific to France.

⁵ Calvo-Garrido, C., Roudet, J., Aveline, N., Davidou, L., Dupin, S., Fermaud, M. (2019) Microbial antagonism toward *Botrytis Bunch Rot* of grapes in multiple field tests using one *Bacillus ginsengihumi* strain and formulated biological control products. *Front. Plant Sci.*, 10. <https://doi.org/10.3389/fpls.2019.00105>

⁶ Butault, J.-P., Dedryver, C.-A., Gary, C., Guichard, L., Jacquet, F., Meynard, J. M., Nicot, P., Pitrat, M., Reau, R., Sauphanor, B., Savini, I., Volay, T. (2010). Synthèse du rapport d'étude Écophyto R&D : quelles voies pour réduire l'usage des pesticides ? Paris, FRA : Inra Editions. 90 p. <https://prodirna.inra.fr/record/38087>

⁷ Geny, L. & Dubourdieu, D. Le millésime 2015 à Bordeaux (2015). http://bordeauxraisins.fr/images/millesimes/millesime_2015.pdf