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The EoleDrift test bed: a new tool to help identify spraying techniques and practices to reduce drift in viticulture

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The reduction of spray drift when applying crop-protection products is a major issue for all stakeholders in the viticultural sector (winegrowers, equipment manufacturers, agrochemical companies, public authorities, neighboring residents). To meet societal expectations for spray drift reduction while maintaining the quality of application required for crop protection, there is a need to test the technical solutions available. The EoleDrift test bed, developed for this purpose, uses artificial wind and artificial vegetation. It has produced its first results.

The EoleDrift test bed has four main components: a blower unit; 4 rows of artificial vines (made up of windbreak nets with dimensions and aeraulic properties similar to the vine); an overhead drift collection device made up of polypropylene wires stretched between two masts; and sensors to record the weather conditions. Figure 1 below shows a plan view of the EoleDrift test bed.

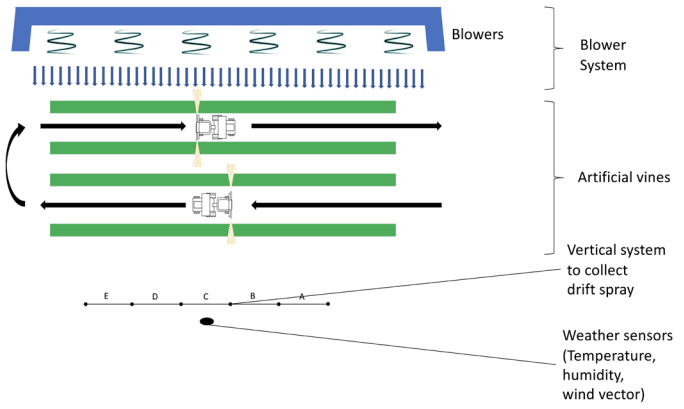


FIGURE 1. Schematic arrangement of the EoleDrift test bed in plan view.

The principle of the drift measurements carried out on the EoleDrift test bed is as follows: for each spraying technique tested, a spray spiked with a tracer (Brilliant sulfaflavine) is applied to all 4 rows of artificial vines while the blower unit generates a wind perpendicular to the rows (initial cross-section 25 m^2, air flow 200 m^3/s). A vertical drift collection device made up of 2 mm diameter wires is installed downwind to capture the drift spray. After the spraying test, the collection wires are recovered and analyzed in the laboratory.
Figure 2 below shows a photograph of the EoleDrift test bed.

The artificial vegetation on the EoleDrift test bed can mimic two growth stages. The "start of canopy" conformation represents the vegetation receiving the first sprays of the season (height 60 cm). The "full canopy" conformation represents that observed at the end of the spraying season when the vine is fully grown. The system can be configured to represent both wide and narrow inter-row spacing.



FIGURE 2. Photograph of the EoleDrift test bed with the artificial vines in "start of canopy" conformation.

Preliminary results - Repeatability of mean drift measurements

During the latest trials carried out on the test bed, several series of drift measurements were made using various spraying techniques. The repeatability of the mean drift measurement over the entire collection area was assessed. Table 1 below details the coefficients of variation of the replicate measurements (standard deviation of the series of replicate "mean drift" measurements divided by the mean for the series).

The results show that for the various spraying techniques trialed on the EoleDrift test bed using the method developed in 2019, repeatability of the measurements (in terms of the coefficient of variation) is between 20 % and 42 %. Compared with field measurements, the repeatability of the measurements therefore seems to be improved (IFV 2006 results). This level of repeatability, expressed as the coefficient of variation (CV in %) should be looked at in the light of: (i) the very significant differences in drift levels observed between the different spraying techniques assessed and (ii) the goal of discriminating between the effectiveness of the various vineyard sprayers available

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TABLE 1. Coefficients of variation of the replicate drift measurements for several spraying techniques on full canopy.

Spraying technique	Number of replicates	Coefficient of variation (%)
Recovery panel no. 1 pneumatic version	3	28
Recovery panel no. 1 air-blast version with air injection nozzles	3	38
Recovery panel no. 2 with conventional nozzles	3	42
Recovery panel no. 2 with air injection nozzles	6	25
Pneumatic boom, driven through every other row	4	20

on the agricultural equipment market. The adopted thresholds for drift reduction classes are 66 %, 75 %, 90 % and 95 % reduction with respect to a benchmark. The repeatability of the measurements appears sufficient to be able to discriminate between the spraying techniques and assess them according to European drift reduction classes.

Preliminary results - Initial comparisons of drift levels for different spraying techniques

Figure 3 below shows the drift measurements obtained for several spraying techniques. Each spraying technique was subject to replicate measurements. Each bar in the chart represents the mean of the drift measured for each replicate. At this stage of the work, the number of replicates for most of the techniques tested is too low for statistical tests to be applied. These preliminary results should be interpreted as qualitative trends, without making a judgment at this stage on the drift reduction classes that could be associated with a given machine or technology.

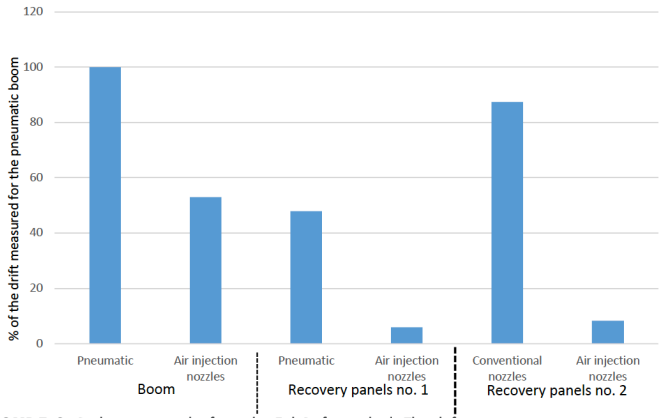


FIGURE 3. Preliminary results from the EoleDrift test bed. The drift measurements are expressed as a % relative to the "pneumatic boom" technique.

The drift measurements shown in Figure 3 above are very variable from one spraying technique to another. The two techniques using recovery panels and air injection nozzles offer the greatest drift reduction compared with the pneumatic boom.

For the boom-type sprayer tested, the results show that changing from pneumatic to air-blast with air injection nozzles could reduce drift by a factor of 2.

Techniques using air injection nozzles provide the highest levels of drift reduction in the data set presented. This is in agreement with the information available in the literature[1]. Indeed, droplet size is the major factor affecting drift. The larger drops produced by this type of nozzle compared with conventional nozzles are less subject to the effects of atmospheric conditions (wind, low humidity, etc.) which can disrupt their trajectory.

The results presented here cannot at this stage be extended to all spraying techniques of a particular type. Further studies will be required to analyze the variabilities observed within each type of technology.

Conclusion and future work

The first results show the promising potential of the EoleDrift test bed for carrying out comparative drift measurements with greater reliability and repeatability than previous field measurements and under acceptable conditions of productivity and cost.

While it is still too early to make definitive recommendations that can be applied generally, these first results confirm the existence of spraying techniques that can very significantly reduce drift compared with those most commonly used today. In particular, it appears that the use of air injection nozzles in conjunction with air-blast equipment, working near the target and with reasoned use of air, is a promising solution. However, despite the many references demonstrating the quality of protection obtained with these nozzles, their use is still controversial for many winegrowers. For effective deployment of spraying techniques making it possible to reduce drift in the vineyard, change-over and support work should therefore be planned, certainly in collaboration with nozzle and sprayer manufacturers, agrochemical companies and the various stakeholders in the sector (advice, training, etc.). ■

Sourced from the article: EoleDrift : la dérive des pulvérisateurs au banc d'essai" (Phytoma - La santé des végétaux n° 741, février 2021).

1 Nuyttens, D., W. A. Taylor, M. De Schampheleire, P. Verboven, and D. Dekeyser. 2009. "Influence of nozzle type and size on drift potential by means of different wind tunnel evaluation methods." *Biosyst. Eng.* 103 (3): 271–280. https://doi.org/10.1016/j.biosystemseng.2009.04.001.

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