IVES Technical Reviews
vine & wine

https://doi.org/10.20870/IVES-TR.2024.8374

Effectiveness of hedges and nets in reducing the risk of drift and exposure of local residents during vineyard spraying: initial results

Adrien Vergès[1], Olivier Naud[2], Elodie Trinquier[1], Xavier Ribeyrolles[2], Amélie Horain[1], Sonia Grimbuhler[2], Jean-Paul Douzals[2], Sébastien Codis[1]

[1] IFV, Institut Français de la Vigne et du Vin, French Wine and Vine Institute, INRAE Lavalette Montpellier, France
[2] ITAP, Univ Montpellier, INRAE, Institut Agro, Montpellier, France

IFV and INRAE have used the EoleDrift test rig to measure the drift reduction performance of two types of plot modification (shrub hedges and windbreak nets). Whatever the sprayer used and the type of drift measured (airborne, sedimentary, exposure of mannequins), the reduction rates measured in the presence of physical barriers are relatively stable and high. By combining such barriers with efficient spraying equipment, reduction rates of over 95 % can be achieved.

Experimental setup on the EoleDrift test rig

The Institut français de la vigne et du vin and INRAE have used drift measurement methods recently developed on the EoleDrift test rig to assess the effectiveness of several types of plot modification in reducing drift. The EoleDrift test rig consists of a blower unit (a wind wall 5 meters wide and 5 meters high with 25 fans) to standardize wind conditions during trials, and four rows of artificial vines. The setup facilitates drift measurements under semi-controlled conditions that are more reproducible than in the field[1].

Two types of physical barriers installed along the edges of plots were tested in 2022 and 2023: a reconstituted living hedge with aligned potted bay plants averaging 2.5 m in height; and a 3 m-high windbreak net supplied by FilPack - model bv106 (Photo 1). Both types of physical barrier were installed 2.5 m from the last row sprayed. The effect of these modifications on the exposure of local residents to spray drift has been little documented in the literature to date.

During the trials, 3 drift measurement methods were used simultaneously to provide complete metrology of the phenomenon[2 3]. Several types of drift collector were used. Petri dishes placed on the ground collected sedimentary drift in the horizontal plane: five lines of ten dishes were installed at 1.25, 3, 5, 10 and 20 m from the last row of artificial vines sprayed. Horizontal wires stretched between a height of 0 and 6 m collected airborne drift in the vertical plane at 5 m from the last row sprayed. Lastly, mannequins wearing cotton T-shirts were placed at 3, 5, 10 and 20 m to collect drift in a form that could be used to assess human exposure.



PHOTO 1. EoleDrift test rig and the physical barriers tested: FilPack "bv 106" artificial net, top left; and bay hedge, top right and bottom.

For both types of physical barrier studied, drift measurements were carried out using two different spraying techniques: a pneumatic boom (4-arm 4-nozzle pneumatic boom, Dhugues SARL, Pouyastruc, France) (considered the "benchmark" type as it is so widely used) and a side-by-side tractor-mounted sprayer equipped with air injection nozzles (800L model rear boom side-by-side tractor-mounted sprayer, Calvet, Lézignan Corbières, France). Drift reductions obtained by any other spraying technique were expressed as a percentage reduction compared with the drift level measured for the pneumatic booms.

For both types of sprayer, drift measurements were made by simulating the "treatment" of four rows of artificial vines by spraying a water solution spiked with a tracer (sulforhodamine B). There were 3 repetitions of each trial. On each repetition, to reduce the variability of the results, the 4 rows of vines were sprayed 5 times in succession. The results presented here correspond to one-fifth of the drift value measured on the collectors, so as to express the drift resulting from a single pass by the sprayer.

Results: reduced drift with both types of physical barrier

Figure 1 compares the airborne drift profiles measured with and without a physical barrier, a live hedge (left graph) and an artificial net (right graph) respectively, in two scenarios: spraying with the pneumatic boom and spraying with a side-by-side sprayer with air injection nozzles fitted on the drop legs. The drift level shown on the x-axis is expressed in standardized units, namely the quantity of tracer measured per unit of exposed wire area, divided by the full quantity of product applied to the plot, multiplied by 100 to obtain a percentage. For each protocol, there are 3 curves. The first is a dark-colored curve connecting the points. This is the mean of the 3 repetitions. This first dark curve is framed by two lighter curves connecting the dashes. These are the minimum and maximum drift values measured over the 3 repetitions.

On average, when spraying with the pneumatic boom, over the entire height of the profiles measured (0 to 6 m), the hedge reduced airborne drift by 74 % and the artificial net by 85 %, i.e. a 5-fold and 6.6-fold reduction in airborne drift respectively.

Airborne drift, sedimentary drift and exposure of local residents in the presence of nets

For trials carried out with the two different sprayers, Figure 2 shows the drift reduction rates obtained using the "FilPack bv 106" artificial net as a function of the type of drift collection: airborne drift collected

The translation of this article into English was offered to you by Moët Hennessy. Moët Hennessy

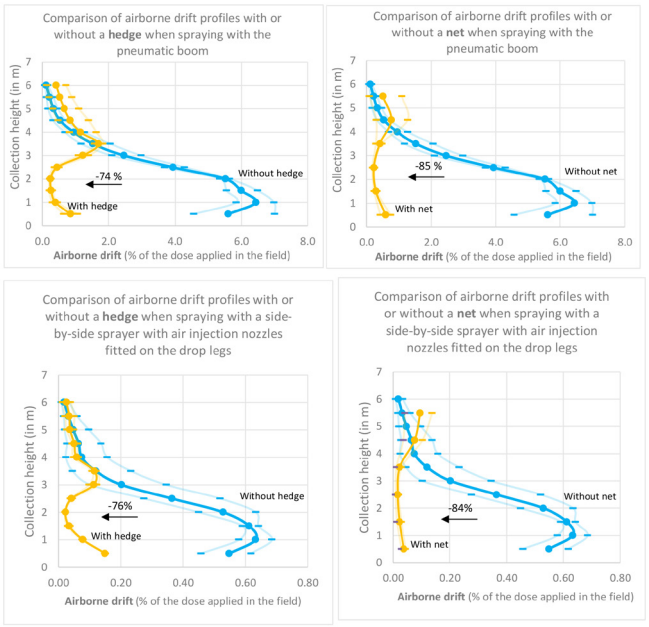


FIGURE 1. Comparison of vertical profiles of airborne drift measured (all other things being equal) in the presence or absence of a hedge (left) and net (right) when spraying with a pneumatic boom (top graph) or with a side-by-side sprayer equipped with air injection nozzles (bottom graph).

on wires at a height of 0 to 6 m, sedimentary drift collected in Petri dishes placed on the ground and human exposure measured using mannequins. Drift reduction rates are calculated by comparison with the scenario with no physical barrier for each of the two spraying protocols. These are average reduction rates calculated over 3 measurement repetitions.

The experimental results show the benefits of installing an artificial net to reduce drift. Whatever the spraying technique used and whatever the type of drift measured, the reduction rate is quite stable, ranging from 84 % to 96 %.

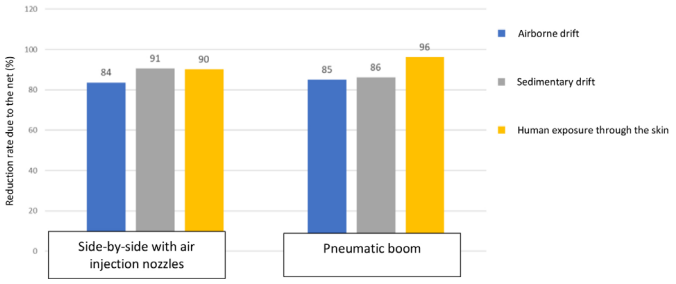


FIGURE 2. Reduction rates for each of the three types of drift (sedimentary, airborne and human exposure) measured in the presence of the net for two different sprayers. For each of the two sprayers used for these tests, these reduction rates are expressed by comparison with drift measurements taken in the absence of the net and with the same sprayer.

Combining physical barriers and other anti-drift techniques

Physical barriers can be used in combination with other means of reducing drift, in particular those linked to the use of high-performance spraying equipment. Figure 3 shows the reduction rates for the different types of drift in a scenario combining the presence of an artificial net and the use of side-by-side equipment fitted with air injection nozzles (officially recognized as a means of reducing drift by 66 %). The drift reduction rates presented are expressed in relation to the baseline scenario using a pneumatic boom in the absence of a physical barrier. This combination of means achieved reduction rates in excess of 95 % compared with the baseline scenario. Hence, the presence of the physical barrier significantly enhanced the drift reduction rate achieved by using side-by-side equipment fitted with air injection nozzles. ■

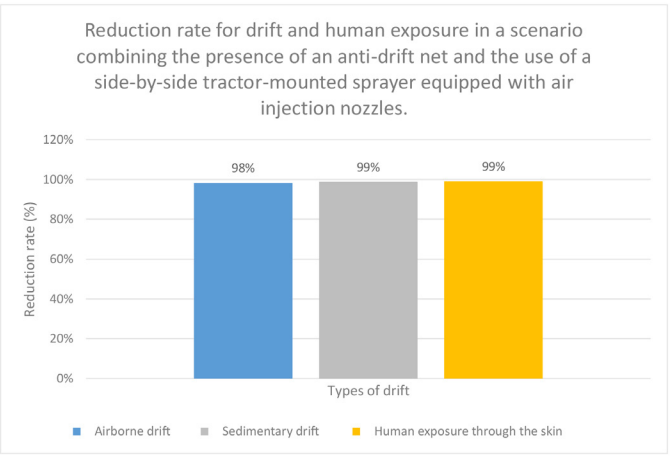


FIGURE 3. Reduction rates for the three types of drift measured in the scenario combining the use of a side-by-side tractor-mounted sprayer equipped with air injection nozzles and the installation of an artificial net, expressed in relation to the baseline scenario using a pneumatic boom with no physical barrier.

Acknowledgements: *The development of drift assessment methodologies on the EoleDrift test rig and these trials were carried out as part of the inter-sector project CAPRIV (Concilier Application des produits phytopharmaceutiques et Protection des RIVerains) financed by the CASDAR fund (2021-2022) and the DRIFTPROTECT project. The latter is financially supported by the OFB and the ECOPHYTO program (2023-2024). The authors thank FILPACK https://filpack.fr/protection/ for lending us the nets, and sprayer manufacturers Dhugues and Calvet for providing the machines used in these trials.*

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