Practical aspects of the use of grassed or wooded buffer zones to control water pollution by pesticides

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J.J. Gril, J.G. Lacas

Cemagref, 3bis quai Chauveau, 69336 Lyon, France gril@lyon.cemagref.fr

Grassed and wooded buffer zones are a tool to control pesticide transfers by surface runoff from cultivated plots to streams. This poster summarizes the main technical aspects of this question and proposes new developments, based on recent scientific references.

Scientific basis

Two recent reviews (Lacas et al. 2005a, Krutz et al. 2005), resume the state of the art concerning the ability of grassed buffers to control pesticide pollution The most important conclusions for practical application are listed here after. The first results concerning the fate of infiltrated products (Lacas, 2005b) are also presented.

Efficacy of grassed buffer zones (review)

In Europe and under natural conditions, removal efficacy is **in most of cases superior to 50 % and often superior to 90 %.**

Such efficiency is **firstly** due to a high **infiltration** rate (> 10 cm/h) in the topsoil of most buffers.

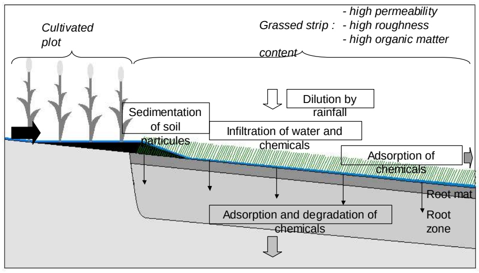
And also to:

-a high surfacic roughness that induces the **sedimentation** of soil particles, mostly coarse ones.

-a topsoil layer rich in organic matter that induces a high potentiality for pesticide **adsorption**

-the **dilution** process due to the rain falling into the buffer (lowering concentrations).

Nevertheless, the literature shows that such systems can also be poorly efficient. Somel arguments cited are the concentration of flow, the soil compaction by engines or cattles, the soil water saturation, the transport of pollutants on fine particles with a too short transfer time.

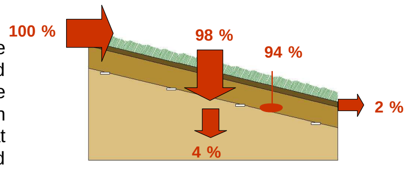


Processes occurring in a grassed buffer (Lacas et al., 2005a)

Buffer zone in the Beaujolais vineyard

Fate of infiltrated chemicals (first results)

Despite a general agreement about the importance of the infiltration process, the fate of infiltrated pesticides has been scarcely studied until now. The first balances, established for the herbicide diuron at the scale of the root-layer (0-50cm), show that the risk of rapid and deep percolation of infiltrated pesticides through the macroporosity seems to be limited, at least at the event scale.



Example of mass balance established with diuron, for a natural realistic event (Lacas, 2005b) Experiment in Beaujolais vineyard – sandy soil

Practical aspects

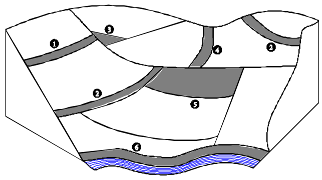
Six questions encompass the main aspects of buffer implementation for pesticide control.

For which pesticides?

According to the important role of infiltration, buffer may be efficient for the retention of pesticide with **a large range of persistence and adsorption characteristics**. Nevertheless, **strongly adsorbed pesticides** are better retained on the top layer of the buffer and in the sub-soil. In the same way, quickly decayed molecules are less likely to be transferred to water through sub-surface flow. The application season also plays a part. Generally, pesticide transfer mostly occurs in the events following application: substances applied when the buffer is near to water-saturation may be not or poorly retained.

Where buffer zones have to be located ?

Locating them along the streams is the most common idea. It is an evidence concerning drift control, but less for runoff control, because: (i) the length of potential sub-surface waterways towards the river is short; (ii) concentrated flows, ditches, drains by-passing the buffer are more frequent along streams and (iii) water-saturation also**. Then, complementary up-slope buffers should generally be associated to riparian ones**.



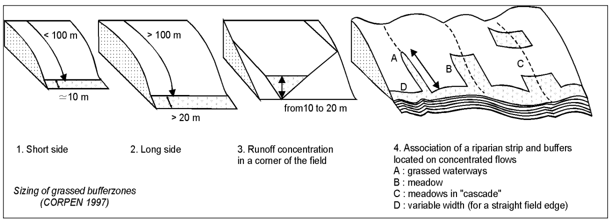
Different possible location of a buffer in a watershed (CORPEN 1997)

Which sizing ?

The French recommendation is **10 to 20 m**, with a special treatment of talwegs. The American proposal is **15 m** (USDA, 2000). Such empirical values must be adapted to local conditions, particularly to take into account concentrated flow and the sub-surface fate of pesticides. The incertitude concerning the fate of pesticides infiltrated into the buffer should lead to propose **higher width for riparian zones** than for up-slope ones.

Which complementary facilities?

Contour spreader-seepage furrows or vegetated fences may considerably improve the buffer efficiency as they disperse concentrated flows.



Sizing and assembling of buffers (CORPEN 1997)

Fence in a wooded buffer to stop gullying and to disperse the flow

Which maintenance?

An annual mowing is often sufficient for **maintaining a grass cover**, avoiding early period to preserve animal reproduction (partridge). Gullying and disappearance of the vegetal cover have to be repaired. In erosive areas, the settlement of coarse particles at the upper edge of the buffer has to be corrected, in order **to avoid concentration and diversion of flow.**

Which type of vegetation?

For **transfer control**, any sort of grass (or wood), maintaining good infiltration conditions is appropriate: the best species or blend is the one adapted to local conditions. On the other hand, to improve **biodiversity** and **cynegetic quality**, all species are not equivalent.

Grassed waterway in Normandy

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