

EcoFlow

Experimental assessment of 2D flow velocity fields induced by plant biodiversity in open channels for seed transport

ABSTRACT

Plants disperse over the agricultural landscapes mainly through seed vectors, the latter being transported either by fauna, gravity, water or wind. Seed dispersal contributes to the spread of invasive species, crop contamination by weeds or biodiversity conservation. Especially for hydrochorous species, i.e. plants whose seeds are dispersed by water flows, there is a complex link between the plant, the seeds and the water dynamics that needs to be disentangled. Indeed, these different plant patterns induce diverse effects on mean water velocity and turbulence fields, largely determining all types of solid transport. However, this potential of plant biodiversity for controlling these transport properties is for the moment largely unknown and under-exploited.

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Flagship project : no

Project leader : Fabrice Vinatier

Project leader's institution : INRA-INRAE

Project leader's RU : LISAH

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Total budget allocated (including co-financing) : 19996 €

Funding : Labex

GOAL

The two main objectives of the project are resumed as follow :

- * Testing innovative methods for the characterization of water mean velocity and turbulence fields, applied to seed transport in vegetated channels
- * Conducting an integrated analysis for the understanding of water dynamics and seed transport induced by biodiversity (different morphotypes and plant spatial organizations)

ACTION

Two types of seed release' experiments were conducted in the experimental channel : (i) The first one aimed at characterizing the retention rate of seeds in patches of vegetation with constant lengths in order to assess the effect of density, species and discharge on seed retention (ii) In the second experiment, the same plant density was planted on one to height panels in order to characterize the effect of the length of the patch on the retention and test the hypothesis of additivity of seed retention.

RESULTS

The results showed that the density, the discharge or the type of species significantly affect the rate of

seed retention. Based on significant additive effect of the length of vegetated channel on the rate of seed capture, we proposed an additive model of recapture following a power law.

PERSPECTIVES

The project ECOFLOW, by using an innovative experiment, paves the way to a better understanding of hydrochorous dispersal in ditches, with consequences on the management of weeds in agricultural watersheds.