

GERIHCO - Gestion des Risques et Histoire des coulées boueuses

An interdisciplinary approach to understand the muddy floods risk

(Alsace - France)

The interdisciplinary research program GERIHCO (for "Gestion des Risques et Histoire des Coulées Boueuses - Risk Management and History of Muddy Floods) started in 2005 with a pool of a dozen researchers from various disciplines (geography, economics, sociology, etc.) interested in studying the risk of muddy floods in the Alsatian region.

The main issues studied are (Fig 1):

MUDDY FLOODS RISK



Fig 1 : GERIHCO and the disciplines involved in the program

1) Physical and agronomic processes

Reduced tillage, runoff and soil erosion decrease and rethinking the use of pesticides (Anne-Véronique Auzet - LHYGES, Paul van Dijk and Rémi Koller - ARAA)

The cultural practices without ploughing have positive effects as they decrease runoff and erosion. But there are some known consequences of these practices on agronomic issues such as biological activity in the soil and sanitary situation in the fields (weeds and parasites, for instance).

The aim of this workpackage is to assess the level of pesticides employment under such cultural practices. Is it more/less important and does it impact the environment more than in conventional systems?

Two indicators are used:

- I-PHY (INDIGO software®) assesses the potential environmental impacts of the pesticides products, taking into account local conditions of application and combining the analysis of 4 risks: Risk deep water; Risk surface water; Risk Air; Risk Dose (Fig 2)

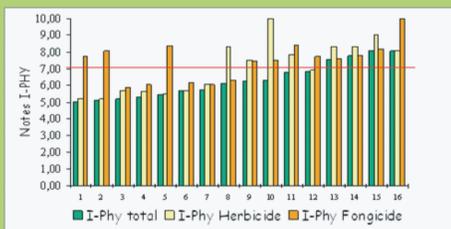


Fig 2: I-PHY indicators for the wheat (values more than 7 are acceptable for environment)

- TFI, Treatment Frequency Index (or IFT in French) assesses the intensity of the pesticides employment. The TFI of reduced tillage systems is compared with known regional values (Fig 3).

	IFT Total	IFT Herbicide	IFT Hors Herbicide	...including IFT fongicide
	(Mean. pond)	(Mean. pond)	(Mean. pond)	(Mean. pond)
	[min-max]	[min-max]	[min-max]	[min-max]
Winter Wheat (16 farmlands and 333 ha)	3,54	1,14	2,19	1,57
Reduced tillage surveys	[1,8-5,23]	[0,0-2,63]	[0,8-3,65]	[0,0-2,48]
Mean IFT surveys 'agricultural behaviors in Alsace' SCEES 2006 (Agreste Alsace, n°9, feb 2010)	2,68	1,09	1,59	1,09
Ref IFT in Alsace 2008 (Ministry of Agriculture)	3,34	1,29	2,05	NR

Fig 3 : TFI index for the wheat

4) Sociological issues

Sociological analysis of the farmers' behaviors concerned with soil erosion (Guillaume Christen and Maurice Wintz - CRESS, Anne-Véronique Auzet - LHYGES, Rémi Koller - ARAA, Anne Rozan - GESTE)

This workpackage deals with the understanding of the farmers' behaviors as they are concerned with soil erosion and environmental issues. The sociological study focuses on the farmers points of view, which are the very last stakeholders in the risk management decision system. Surveys and individual interviews were conducted in 3 villages, frequently concerned by muddy floods (Morschwiller, Breuschwickersheim, Obermorschwiller - Fig 6).

Three main issues identified are:

Result 1: The weight of the social aspirations or "check valves".

Considering the social trajectory of farmers, when they move away from their "organic dependence", the crop advisors become the structuring professional. Associated to this, the "check valves" make impossible to return to previous situations.

Result 2: Adoption of reduced tillage practices and "technical" knowledge of the soil

By adopting reduced tillage practices, the farmers show a different relationship with their soil. They adopt more technical and professional views.

Result 3: Diffusion of innovative systems

The way such innovations are diffused among the farmers is important in their adoption: the participative approach allows the farmers to mobilize their expertise and to propose solutions.

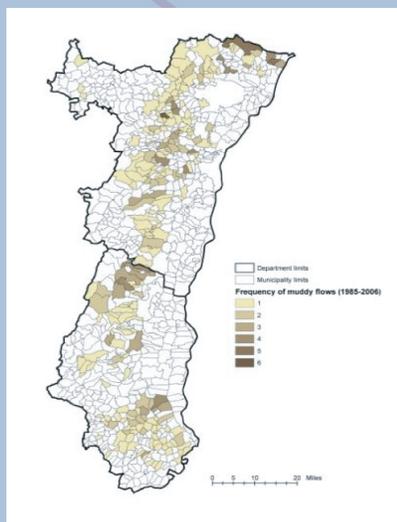


Fig 6: Frequency of the muddy floods in Alsace

3) Economic impacts

Economic analyses of the adoption of cultural practices without ploughing (reduced tillage) - (Rémi Koller - ARAA, Anne Rozan - GESTE)

The aim of this workpackage is to carry out an economic analysis of the reduced tillage implementation for Alsatian crops farms, by using technical and economic indicators derived from SYSTERRE®. The used data were gathered in four agricultural farms in reduced tillage and confronted to an Alsatian farm-type from ARVALIS (DMNI), to compare with a traditional ploughing system.

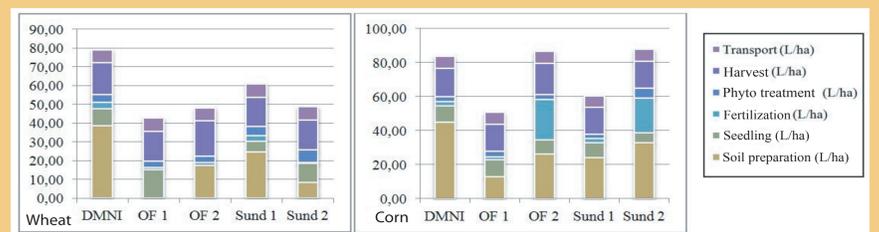


Fig 4: Gasoil consumption for wheat and corn (L/ha)

The results show that reduced tillage:

- maintains yield levels
- reduces working time and gasoil consumptions (Fig 4)
- maintains a direct margin compared to ploughing system (Fig 5)
- improves this margin under the condition that the costs of mechanization are optimized by a better depreciation (by increasing cultivated areas and/or by using pool of equipments such as CUMA or shared property)

	DMNI	OF 1	OF 2	Sund 1	Sund 2
Profit Margin without subv (€/ha)	1144	1004	1377	748	1280
		-12%	+20%	-35%	+12%
		Δ = -139	Δ = 232	Δ = -395	Δ = 136
Direct Margin without subv (€/ha)	642	587	807	175	708
		-9%	+25%	-73%	+10%
		Δ = -55	Δ = 164	Δ = -46	Δ = 65

Fig 5: Direct and profit margin

Muddy Floods Risk

2 & 5) Psychosocial analyses, behaviors and modelling

Analysing the perception of protective measures and modelling their efficiency (Carine Heitz - GESTE, Sandrine Glatron - LIVE, Florence Le Ber and Anne-Véronique Auzet - LHYGES)

The main researches on muddy floods risks focus on the decreasing of on and off-site impacts. Several measures can be taken: agronomic measures, policy measures, economic measures. A dialogue between all stakeholders has to be initiated to define the best practices and the best way to manage muddy floods and their damages. The psychosocial analyses (based on questionnaires) allow us to understand the agents' behaviors and to identify the potential protective measures they should adopt.

Surveys among farmers highlight their willingness to set up fascines in their fields. The results show that:

- they perceive fascines as a "solution of emergency"
- negative aspects mainly concern the cost, the integration in the landscape and the care and maintenance of the fascines
- there is a lack of information dealing with the protective measures and their efficiency.

Fascines were implemented in Alsace during 3 years (2008-2010). In 2011 a survey was performed to assess their efficiency with regard to the watershed characteristics (slope, surface, land-use) and their own characteristics (length, location - Fig 7). This survey shows that fascines were only partially adapted to prevent muddy floods, for small and slightly sloping watersheds.

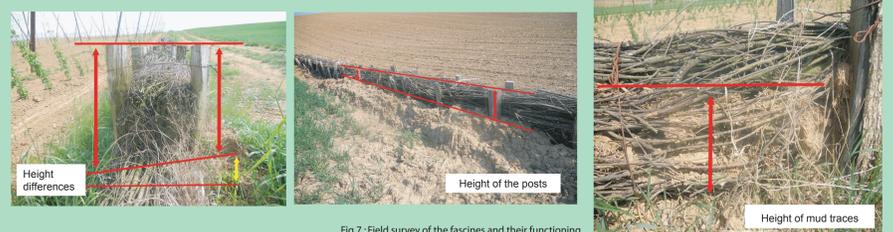


Fig 7: Field survey of the fascines and their functioning

To go further, and to carry on what was mentioned in the previous point (agricultural practices), it could be interesting to propose to co-build methods of prevention to involve all the stakeholders and to promote innovative measures.



Financial support by Rhin-Meuse Water Agency

Contact - Scientific coordinator
Anne ROZAN
Professor
GESTE - Strasbourg (France)
anne.rozan@engees.unistra.fr