HOW TO COMPARE BEST AGRICULTURAL MANAGEMENT PRACTICES AT THE WATERSHED SCALE?

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Abstract: To design the restoration plans requested by the European Water Framework Directive, local regulators need to implement technically designed modifications of farming practices. Their main interest relies on the determination of which modifications are the most appropriate to the local conditions. To help this decision process, a selection grid has been built within the European AgriBMPWater project (5th RTD Framework Program). The main interest of this grid is to allow the comparison of different "Best Management Practices" regarding their environmental effectiveness, the associated costs and their acceptability for farmers. This paper presents the different steps of the method, some tools that have been used and their technical requirements, illustrates with some results the integrated tool that has been developed and provides keys for interpretation.

Key words: Non Point source pollution; Efficiency ; Cost; Acceptability; Best Management Practices ; Critical areas.

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1 INTRODUCTION

Because they had to deal with the increase in surface and groundwater pollution, EU Member States undertake policies aiming at reducing the negative impacts of the agricultural activities on water quality. These policies took various forms, from the promotion of "agri-environmental schemes" with the CAP, or the mandating of "good practices", restoration plans according to the Nitrate the Water Framework Directives.

For the farmers, most of these changes consist in the adoption of Best Management Practices (BMPs), designed by technicians. There are hundreds of environmentally friendly practices and there is a need to select among them the most cost-effective ones and those which are liable to be the most easy to adapt for the farmers.

Preliminary assessments of these programmes show that they have only little impact throughout Europe. The usual explanations of the farmers low commitment was that either the farmers resist or the BMPs are badly designed or insufficiently explained to the farmers. Experience showed that BMPs with low implementation rate encounters difficulties in the different phases of the policy implementation, from design to information dissemination.

Because difficulties occurred more often during the integration, there is a need to create an integrated assessment framework for BMPs. The framework should take into consideration :

- firstly a cost/effectiveness approach to assess BMPs appropriateness to environmental and economic objectives ;
- - secondly, an acceptability approach to estimate the potentiality of farmers joining BMPs;
- - and finally an evaluation of the implementation practices, that should be initiated to ensure a better information of farmers.

Moreover, it was not rare that several BMPs would be implemented on the same area, with complementary or opposite objectives, leading to redundancy or cancellation of allowed supports. Lastly, alternative environmental friendly practices were proposed to farmers without considering the diversity of the watershed situations. Thus, the integrated framework proposed could improve the implementation of BMPs on critical areas so that they may be more efficient, at lower cost, and with a higher rate of acceptability.

This paper provides insights into different approaches to compare BMPs in a 3 dimensional space defined by environmental effectiveness, economic consequences and social acceptability by farmers and land-users. These approaches have been developed and tested during the EU FP5 research project AgriBMPWater.

2 BEST MANAGEMENT PRACTICES

2.l Definition

Agricultural BMPs can include fairly simple changes such as fencing cows off of streams, planting grass in gullies to reduce the amount of sediment transported by runoff water or ploughing reduction in fields with row crops to control soil erosion and related pollutant transfer. Most BMPs concern farming practices at field scale, such as rate of manure spreading, or split application of fertilisers, mulching or specific irrigation techniques. Some of these BMPs are liable to greatly modify the production system because they may affect the crop yields or the forage production. BMPs can also involve the building of structures such as large manure storage tanks that allow farmers to spread animal waste at appropriate periods.

2.2 Design of BMPs

Usually, the design of a restoration plan starts with the diagnosis of the watershed, including the different uses for water, its quality and available quantity depending on the different periods of the year. This diagnosis is often performed by consultants with few relationships with the other potential users on the watershed. To improve the appropriation of diagnosis by all the actors on a watershed it is highly recommended to involve them at the earliest stages of the restoration plan. The design of BMPs can be a good step in the procedure to begin an active cooperation.

Many BMPs have already been tested and experienced in various watersheds throughout the European Union. Appropriate BMPs can be locally designed through interviews with administrations, professional advisors and elected representatives in order to describe the history of environmental measures tested on the watershed, share experience from other regions and define practices that could match the local situation.

Improving the fertilisation practices
Application of all the manure produced within the watershed, then adjustment of inorganic fertilization to meet crop needs; Decrease of mineral nitrogen amounts; Use of fertilisation guidelines to adapt the amount of spread nutrient closely to the plants requirements.
Modification of rotation
Local crop rotation with additional catch crops during winter period; Green fallow; Change from maize to meadow, alfalfa or ryegrass-maize rotation.
Modification of soil structure and porosity to reduce erosion and P transfer

Catch crop implementation; Mulching on maize fields; Grass under permanent cultures and vegetative filter strips.
Improving drainage water quality on acid sulphate soils (Bärlund et al., 2002)
control drainage ; lime filter drainage.
Improving the pesticides management
Weed control by a combination of mechanical and chemical measures; Application of herbicides in the rows and mechanical weeding between the rows.
Economic policies
Increase of rye grass and clover instead of corn silage to optimise gross margin; Tax on mineral nitrogen; Modification of milk quota; Mandatory quota of bought mineral nutrients.

Table 1: Example of potential BMPs

3 CRITICAL AREAS

3.1 Definition of critical area

Even for slightly modified water bodies, it is obvious that all the components of the watershed do not contribute at the same level to the NPS pollution process. Besides, the least costly way to achieve well-defined environmental objectives for water resource often requires to target the measures to specific areas where they may be more effective, or cheaper to implement.

At this stage of a cost-effectiveness analysis, it is really important that physicists, economists, sociologists and stakeholders agree on a common definition for these priority zones, named "critical areas". This definition will strongly depend on the aim of the study. If only physicists are involved in the river basin management plan, the study will have a natural science theoretical aim and a critical area can be defined as "the minimum area, where feasible measures can be applied, needed to reach the desired quality standard of the considered pollutant at the receptor. When many stakeholders participate in the diagnosis, an operational definition can be adopted and the critical areas are "the sets of areas where feasible measures can be applied needed to reach the desired quality standard of the considered pollutant at the receptor." More often, physicists, stakeholders and economists are involved in the restoration plan. In this case, critical areas can be defined as "the set of areas where feasible measures can be applied to reach the desired quality standard of the considered pollutant at the receptor at the least social cost." (Turpin, et al., 2005).

3.2 Characterizing methods

Although linearly presented, the analysis is iterative: initial analysis is based on existing information, and will be upgraded as new information and knowledge are gathered. The use of a spatialised hydrologic model is of importance to select, among all the watershed areas, some of them where the implementation of BMPs is expected to be more efficient. These models need to be calibrated first on a baseline scenario. Of course, no hydrological model will provide immediate delineation of critical areas. There is a need to rank the specific pollutant loads from each unit area with respect to the others. A sensitivity analysis will provide great help at this stage for the interpretation of ranking the different areas according to their potential effect on the BMP effectiveness. Once the different unit areas from watershed are ranked, their specific simulated effectiveness has to be combined, so that each BMP delineates the areas defined as critical according to the natural science definition. To go further in the delineation of critical areas, the stakeholders and firms interests can be taken into consideration. The areas where potential BMPs are modelled to be most effective may differ from the areas where the same BMPs are more liable to be implemented. Then, the different areas have to be ranked according to both effectiveness and acceptability criteria, before delineating the "critical areas" according to the operational definition. The same procedure can be applied to design critical areas according to the welfare economic definition, the candidate areas being ranked according to a cost effectiveness ratio, their potential acceptability being also considered. Most studies use the physical definition of critical areas only.

4 ENVIRONMENTAL EFFECTIVENESS OF BMPS

4.1 Definition of the environmental effectiveness

The environmental effectiveness of a given BMP is defined within the AgriBMPWater project as the evolution of water quality led from the BMP implementation on a watershed or on some specific areas within this watershed.

Basically, implementing a BMP on a given area will have short term and long term consequences on water quality, while modifying specific discharge, pollutant pathways, nutrient cycles and so on. The effectiveness should be considered as the difference between the baseline scenario and the modified scenario, each system being in equilibrium.

4.2 Assessment method

Effectiveness can be estimated through the introduction in previously validated models of pre-designed BMPs as alternative practices. Each BMP effectiveness can be determined as the ratio between the initial state and the estimated state after BMP implementation, both systems being in equilibrium. Effectiveness is calculated as:

$$Effectiveness\ (\%) = \frac{VA_{BMP} - VAR_{REF}}{VAR_{REF}} X\ 100$$

where VARBMP is a variable measured in a test field or simulated with a specific BMP implemented and VARREF is measured in the reference plot or simulated with ordinary practice.

4.3 Choosing a model to assess the effectiveness

Even though distributed, physically-based models do not in principle require lengthy hydro-meteorological records for their calibration, but they do require considerably more input parameters than the simpler lumped models. Again in theory, the parameters and their spatial distributions could be measured in the field, but the expense of such a survey is obviously not realistic and would prohibit practical implementation of the models. It is therefore necessary to reduce the number of direct measurements and to employ more indirect evaluations readily available from field studies. As the parameter values should be characteristic for the spatial resolution used in the model, the sampling and evaluating of the parameters represent a supplementary difficulty. Many hydrological measurements, for example, are made at the point scale (i.e., of the order of a meter) and may or may not be representative of conditions at the grid scale used in the distributed models. In this regard, parameter evaluation from data provided by remote sensing techniques or satellite information is potentially of great help.

However, while these techniques can currently give surface distributions of watershed properties such as topography, land use or vegetation, they do not provide information on soil type and subsurface soil conditions. Against the above assessment on some of the major difficulties associated with data provision, it is clear that the choice of a model is directly conditioned by the way in which the problem of data provision is handled. Precise guidelines should therefore be specified right at the beginning of the coding effort, rather than in the process of development. As the reality shows that most natural watersheds are often poorly defined in data, three avenues are chosen for the data provision and the type of model chosen:

- The first concerns the need to reduce the number of system parameters to a strict minimum. Even though this point seems obvious, still too many simulation codes suffer from the problem of over-parametrization. The construction of multipurpose models such as integrated hydrological modelling systems is often based on the coupling of two or more pre-existing models. The single models are in principle validated on an individual basis. However, when the single models are used in a combined mode, problems may occur due to the fact that the underlying concepts and parametrization techniques used for each of the individual models are mutually incompatible. A classical example is the sometimes viciously hidden interdependence of system parameters. Overlooking this problem, unavoidably leads to an over-parametrized modelling system.

- The second data provision criterion concerns the structural flexibility of the modelling code. The model should be able to match the sophistication of the solution with the specific project requirements or the availability of data. In this regard, two categories of input data should be considered, i.e., those data which are absolutely necessary to drive the modelling system, and those data which are useful in the sense that their knowledge improves the precision of simulation. Moreover, the flexibility of the model architecture should be able to accommodate different parameter evaluation techniques. As the parameter values are estimated from either direct or indirect measurements, the code should be capable of running the specific configuration out of a wide class without any need for work at the level of the software.

- The last point of importance for a sound data provision strategy concerns the pre-processing of the rough field data. The pre-processor of the modelling code should include tools which are capable of aggregation, disaggregation and/or interpolation (in space and time) of various hydrological and hydro-meteorological input data. When kriging techniques are used, the specifications of the variogram parameters and the choice of the specific variogram model should be defined as a function of the project requirements (e.g., the variograms used for the interpolation of rainfall data change as a function of the geographical project location). As it is often observed that lack of data does not prevent planning or development decisions from being made, supplementary statistical routines should be included that are able to accommodate the partial lack of input data (e.g., incomplete time series of rain data).

BMP	Watershed	VAR $_{REF}$	VAR $_{BMP}$	Effectiveness
Composite BMP 3	Mincio	8748 t N	1726 t N	80.3 %
Weeds under trees and reduction of tillage simulated on 100 % of the critical area	Lake Vico	4876 kg P	1719 kg P	64.7 %
Pesticide treatment strategy for cabbage	Heiabekken	EIQ value 172	EIQ value 120	30.0 %
BMP soil erosion	Grub	250 kg soil/ha	5 kg soil/ha	97.9 %
Control drainage + lime filter drainage	Rintala polder	9684 t SO_4-S	7583 t S-SO_4	21.6 %

Table 2: Illustration of the environmental effectiveness: some results

5 COSTS ASSOCIATED WITH THE BMPS IMPLEMENTATION

The Water Framework Directive integrates economics into water management and water policy decision making. We shall restrict the economic approach to the assessment of the costs associated with the implementation of BMPs, even though the WFD requests wider economic analysis. For a competitive market, consumer plus producer surplus is maximised at a market equilibrium and at a Pareto optimum. But it is well known that environmental protection often requires government intervention to correct market failures and one of the primary tools for deciding of the appropriateness of this intervention in the economy is the benefit cost analysis. The basic idea of this analysis is very simple: find the project that leads to the largest surplus. In general a surplus maximum is equivalent to a Pareto optimum. Implementing this very simple idea is far from being simple. The usual problem is the difficulty to quantify some of the benefits or some of the costs. Efficiency calls for emissions that balance the costs of emissions control with the damage from ambient pollution and fully takes into consideration the complex relations between emissions and damage. When this is not practical, goals or targets are established regarding desired levels of ambient concentrations.

These goals may be only imperfectly related to the efficient levels of pollution because these efficient levels may vary through time and space. Establishing ambient targets is usually a compromise that sacrifices efficiency in pollution control. But even with such a target there are both good ways and less desirable ways of regulating emissions to achieve the target. If a set of environmental measures achieves the target at the lowest cost, the regulation is cost-effective: even though efficiency is not attainable for many regulations, cost-effectiveness is attainable. Basically, the WFD requires the basin management plans to support the selection of a programme of measures for each river basin district on the basis of cost effectiveness criteria.

5.1 Definition of the costs

The cost of a set of measures is the difference in the total surplus between the baseline scenario and the modified situation. The total surplus is the producers', plus the consumers', plus the tax payers' surplus. The producers can belong to the regulated sector (agriculture) or to other sectors of the economy.

Within the AgriBMPWater framework, we distinguished two parts in this difference of surplus:

- the surplus variation that is directly related to the introduction of the measure, named “direct costs”. These costs include the variation of the regulated producers' surplus, the amount of subsidy borne by the tax-payers and the variation of consumers' surplus related to the production variation. For example, subsidising the dairy farms to help them reduce their emissions may induce a welfare variation for milk drinkers (if the milk production is sufficiently modified to affect the milk price), has a cost for the tax payers and may modify the dairy farmers' surplus.
- the surplus variation borne by other components of the economy but the agricultural sector are named "indirect costs". There are several reasons why such indirect costs are likely to appear. On the one hand, would farmers try to compensate for direct costs induced by BMPs implementation, then either they would raise their output prices so that agricultural goods would be more expensive for intermediate and final consumers or, if they cannot do so, they would switch to more profitable products. On the other hand, some public institution may want to be the one who compensates for farmers direct losses in order to promote BMPs adoption; then, either it will have to levy a specific tax somewhere to finance the new incentive scheme, or it should redirect subsidies previously granted to somebody else towards the benefit of farmers who implement BMPs. In any case, if a sufficiently large number of farmers do implement BMPs, agricultural and other markets may be therefore affected together.

5.2 Which measure for which cost?

In any case, the cost is measured as a surplus variation between the baseline scenario and the modified situation. Depending on the size of the watershed and on the candidate BMP, consumers, tax-payers, regulated producers and producers belonging to other sectors of the economy may be affected or not and therefore the expression of the surplus variation may be simplified. Obviously, implementing BMPs on very large watersheds or nationwide leads to a surplus variation for all the components of the economy. For a watershed size close to a river basin district, the production variation induced by the environmental policy is small enough to have no effect on the price, and the consumers' surplus variation can be neglected when assessing the direct costs associated with this policy. When implementing BMPs on a small watershed (less than 100 km2), the indirect effects on the other sectors of the economy can be neglected. If the BMP is associated with a subsidy that compensates the producers' profit losses, then the cost of the BMP is related to the tax-payers' profit variation only.

5.3 How to choose an economic model for this measure?

The choice of an economic model is strongly related to the surplus variations that have to be estimated. When all the components of the economy can be affected by the BMP, only a computable general equilibrium model can estimate the associated costs. On river basin districts, computable general equilibrium models are relevant when the BMP may affect largely the non-agricultural sector of the economy. When the variability of the farms is large, this parameter has to be included in the modelling. This can be done by splitting the watershed into distinct sub-regions where the farming activity can differ. Another way to include the farms variability into the modelling is to use a Principal-Agent model. The farmers are represented as a continuum characterized by a one-dimensional parameter representing their private information. This kind of model allows the design of optimally differentiated policies while providing a menu of contracts adapted to each kind of farm and the associated variation of producers' plus tax-payers' surplus(see Bontems, et al., 2005 for an example of such instrument). When only the tax payers' surplus variation has to be estimated, linear programming models can be used. These models are built at the farm level. The farmer is a profit maximizer that "adopts" a given BMP when the associated subsidy is high enough to ensure him at least the same profit as the baseline scenario. When associated with a typology of farms within the watershed, these linear programming models can easily compute the tax-payers' surplus variation led by the implementation of any BMP. Note that these models are easier than the others to connect with hydrological models when they explicitly represent on-field agricultural practices.

6 ACCEPTABILITY

6.1 Definition

The agri-environmental schemes are based on individual farm-level contracts, which are often voluntary in nature. However, in order to diminish diffuse pollution, a BMP applied in one individual farm is not necessarily enough, In fact, they should be targeted at critical areas and to a group of farms. This requires actions from a number of actors and institutions and at the same time raises collective action problems. The problem of low implementation rates of BMPs is still too often explained by the resistance of farmers only. However, experience has shown that problems also occur in the various phases of the policy implementation and in the dissemination of information. In order to increase our understanding of the social factors that contribute to the acceptability of the BMPs and agri-environmental policy, more attention has to be paid to the implementation practices at the local and farm level. This means giving due consideration to the role of farmers in the agrienvironmental management and policy implementation practices. The evaluation of the institutional setting is of uttermost importance, when the social acceptability of the BMPs and agri-environmental policy is assessed.

6.2 Method

The study of the social acceptability can vary from a survey of willingness to contract to an extensive study of the implementation practices. In the AgriBMPWater project our studies on social acceptability were based on the following methods:

- Simplified case studies, which determined the social factors affecting the “willingness to contract”, main barriers in contracting, legitimacy of the agrienvironmental policy and farmers attitudes towards environmental issues in general. The empirical material was gathered with surveys and focus group studies. The surveys focused on the following issues:

• changes in the environmental management practices,

• acceptability of the agri-environmental policy model and its future development,

• information channels,

• specific questions on BMP contracts (impact on farm management and environment, the level of compensation),

• local environmental problems and actions.

- Extensive case study, which examined the implementation practices of the agri environmental policy at the local and farm level. The study was focused on the analysis of the practices of different actors and interplay between the agrienvironmental implementation and farming practices. Special attention was put on the dynamics of translating policy goals into farming practices and arising intermediary mechanisms. The empirical material was gathered with thematic interviews, observation and surveys.

7 THE GRIDS FOR BMPS COMPARISON

Once all the previous steps have been completed, the integration of the different elements is a very useful decision tool. The integration is performed through a synthetic diagram that depicts on each watershed the contracted area, the effectiveness of the BMP, the associated costs and either the current participating area or the potential area where the BMP is acceptable.

7.1 Illustration of the integrated framework

Now let us summarise the whole framework and illustrate this by a case study. The Grub watershed faces an erosion problem with high discharge loads. To mitigate this erosion problem, three BMPs have been foreseen, A=mulching on maize fields, B=winter crops instead of spring crops, C=changing maize fields to non fertilised grassland.

On this watershed, the hydrological pathways and critical areas have been defined using several methods (field surveys for erosion patterns and flow paths, and modelling). The use of the EUROSEM model, once calibrated and validated, lead to the assessment of the effectiveness for the three BMPs.

Risk	Area with BMP		Mean erosion rate			Effectiveness		
order	ha	% of total area	BMP C t/ha	BMPB t/ha	BMPA t/ha	BMP C %	BMP B %	BMP A %
	0.0	0.0	0.25	0.25	0.25	0	0	0
2	78.5	2.9	0.09	0.12	0.18	66	51	29
3	195.1	7.1	0.04	0.08	0.15	82	67	40
4	319.9	11.7	0.01	0.05	0.13	96	81	50
5	361.1	13.2	0.01	0.04	0.12	98	82	52

Table 3 : Effectiveness of 3 BPMs on the Grub watershed

The use of a linear programming model leads to the estimation of the costs associated with these BMPs.

Risk	Area with BMP		Direct costs			Cost effectiveness ratio		
order	ha	% of total area	BMP C €	BMPB €	BMPA €	BMP C €/ha	BMP B €/ha	BMP A €/ha
	0.0	0.0	0	0	0	0	0	0
2	78.5	2.9	2521	848	856	55	24	43
3	195.1	7.1	6262	2107	2126	109	46	77
4	319.9	11.7	10270	3455	3487	154	62	100
5	361.1	13.2	11592	3900	3936	171	68	110

Table 4 : Cost /Effectiveness of 3 BPMs on the Grub watershed

The integration of the two last steps provides a cost/effectiveness ratio for any BMP, depending on its area of application.

Because BMPs A and B are already parts of national agri-environmental programs, the survey for acceptability included questions on the farmers' opinion about the proposed subsidies.

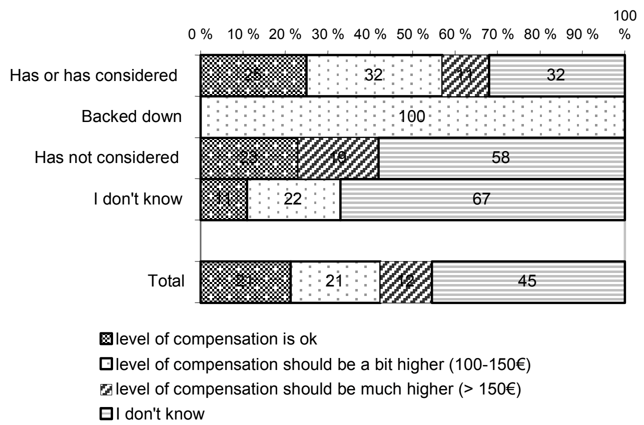

Figure1: Farmers' perceptions of the level of the compensation – OPUL2000 contract for N reduction

According to the survey results we can conclude, that farmers have rather high expectations for the compensation of the costs. There are also differences in the willingness to contract BMPs depending upon the management requirements and effects e.g. on the yield. The results also reveal that the ones who do not have a BMP contract know very little about the possibilities offered by the agri-environmental policies, or do not want to comment on them.

When choosing between BMPs there is a trade-off between costs and environmental effect, exemplified with BMP B and BMP C, where the environmental effectiveness of BMP C is the highest, but also entails larger costs. The question is which of these BMPs to choose. Although BMP B has the most preferable cost effectiveness ratio, BMP C may still be a candidate for implementation if BMP B falls short of the environmental objectives (sufficient improvement in water quality) or the receptor is particularly valuable in terms of recreational benefits etc. Summing up: one needs to remove dominated policies (like BMP A in this example), and then consider the relative importance of the environmental effects (where BMP C scores the best in this example) and cost effectiveness (where BMP B scores the best in this example).

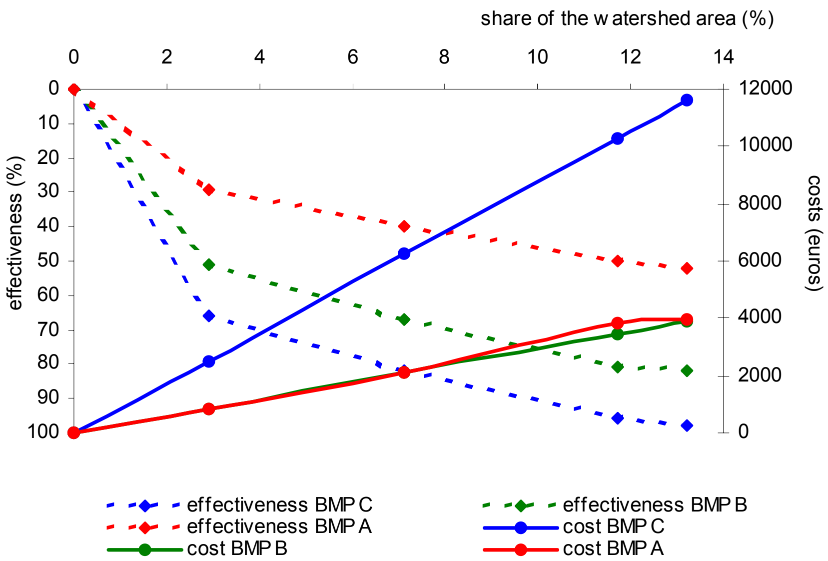

Figure 2 : cost-effectiveness grid for BMPs on the Grub watershed (adapted from Feichtinger, et al., 2004)

Generally, high cost policies (like BMP C) are more difficult to implement. If justified for environmental reasons, i.e., other BMPs fail to reach environmental targets, more care must be taken in terms of designing contract menus ensuring that in relative terms, low cost providers of high cost BMPs implement the BMP first . In practical terms this implies designing contract menus such that make it the dominant strategy of agents (farmers) to truthfully reveal their costs of implementing the BMP. If it is difficult to design policies that make low cost providers adopt the BMP, the concept of critical areas is a helpful tool to identify farmers or fields, where adoption of high cost BMPs are the least costly. The rationale for this is that such micro level cost and environmental effectiveness differences may occur even within a watershed or small regions.

7.2 Interpretation of the grid

Let us take another example. On the Don watershed, the technical BMPs that have been compared are: BMP1= decrease of the inorganic nitrogen spread over all the crops, BMP2 = manure spreads on grasslands instead of corn, BMP3 combines both BMPs 1 and 2 and BMP3b is BMP3 with an adjusted inorganic fertilisation close to the crops requirements. When comparing the size of their implementation area and their simulated effect on water quality on the watershed, it is easy to notice that a regulator with the objective of reaching the EU threshold of 25 mg NO3-/l has to implement these BMPs on a large range on the watershed area (60 % of the agricultural area for BMP3 and 85 % for BMP1). It is now possible to compare this necessary implementation area with the area where the farmers declare themselves ready to implement each BMP: clearly, on the Don watershed, there is no way to conciliate the potential area of BMP implementation (37 % of the agricultural area for BMP3 and 45 % for BMP1) with the simulated necessary area.

Only BMP3b, which requires a high technology level and the capacity to adapt the fertilisation each year depending on the previous climatic conditions could conciliate the regulator's objective and a low level of implementation, but its acceptability (not depicted on the Figure) is too low.

A regulator who would rely on the volunteer adoption of the technical BMPs would never reach his objective of meeting the EU 25 mg/l threshold.

Thus there is a need to design other BMPs. This conclusion is strengthened by the difference noted within the acceptability analysis between the BMPs' acceptability and their feasibility.

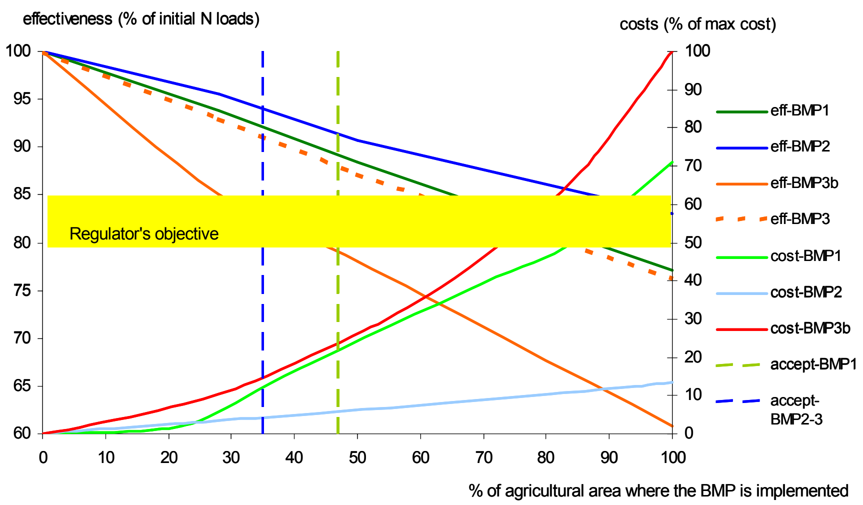

Figure 3 : cost-effectiveness grid for BMPs on the Don watershed

8 CONCLUSION

Stewardship compensation programs must overcome many difficulties, and the most important are enforcements problems when the practices are not easily observed. In spite of these difficulties, EU Member States have to ensure a program of measures to mitigate water pollution within the Water Framework Directive (2000/60/EC) and they need to select among the set of potential measures, the most cost-effective ones. A key issue for selecting a set of cost-effective and acceptable measures is their analysis through a multidisciplinary framework.

The AgriBMPWater project has proposed a framework to compare existing or newly designed BMPs. This approach has been undertaken on three axis, the potential effectiveness of each instrument, the associated costs expressed as the variation of the farmers and the tax-payers' surplus, and the acceptability of the regulation assessed as the proportion of the farmers who benefit from this regulation, or who are ready to voluntary adopt it.

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