



## Time scales as a factor in decision-making by French farmers on weed management in annual crops

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### Abstract

The aim of this research was to improve the advice given by extension institutions to French farmers and to develop a Decision Support System (DSS) for weed control that would match the practical approach adopted by farmers. Farmers running 15 farms with different farming systems in different regions completed comprehensive interviews which allowed them to explain how they deal with weeds. We built temporal diagrams for crop management sequences and decision making. This paper describes the basic framework common to all the farmers interviewed. Each farmer employed pre-established weed control programmes. When designing these programmes, farmers integrated different time scales: the current year, the rotation, and the long term. In the short term, they considered the risks of yield losses and/or lower harvest quality plus harvesting difficulties. In the medium term, they anticipated the risk of finding a weed species in another crop of the rotation where control would be difficult or costly, weighing the risks of yield loss against the cost and effectiveness of solutions, not only in the current crop but also in subsequent crops, so that once again, the rotation was

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the central focus of weed control. In the long term, their main aim was to limit the soil seed bank to an acceptable level. The farmers interviewed stated that they would continue to implement a weed control programme that they deemed satisfactory as long as no new problem appeared, and until they could learn about more effective technical solutions. When designing a DSS that will ensure successful, more sustainable weed management practices, it is crucial to take account of both the complexity of the decision-making process and the multicriteria nature of decision making.

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## 1. Introduction

For many years, weed control in the farming systems of developed countries has relied heavily on selective herbicides. Over the past 40 years, agricultural policy in Western Europe has oriented farming towards the increasing use of inputs, in ever more specialized systems. To maximize their income, farmers have tended to simplify cropping systems, entailing limited diversity in crop sequences, cheaper herbicide solutions and reduced soil tillage. These cropping systems favour the development of weed species with low sensitivity to the herbicides available and some weed populations previously sensitive to herbicides have developed resistance. Furthermore, “the environmental and economic costs of cropping systems that are chemically intensive and contain little crop diversity have become increasingly apparent” (Liebman and Dyck, 1993). Nowadays, more and more residues from herbicides are found in soil, groundwater and rivers (Hallberg, 1986; Thurman et al., 1991; Schiavon et al., 1995; Jaynes et al., 1999; Carabias-Martínez et al., 2000; IFEN, 2004). It is now necessary to promote diversified systems involving reasonable levels of inputs. Modern farming is therefore facing a critical balance between environmental issues and economic profitability.

Due to pressure from public opinion and the authorities, more sustainable production methods are gradually being introduced, but the pest management guidelines currently applied by farmers rarely include innovative techniques that will reduce the environmental impacts of herbicide applications. Knowledge-based changes to more environmentally-friendly weed management practices remain limited. For example, in Europe, the codex for Integrated Farming proposed by the EISA (European Initiative for Sustainable Development in Agriculture) proposes only vague guidelines regarding weed management, such as “Using herbicide products as much as necessary, but as little as possible, always applying legally and in a targeted manner”. Having studied the practices and motivations of ‘conventional’ farmers and ‘innovation’ farmers involved in an Integrated Arable Farming System Innovation Project in the Netherlands, De Buck et al. (2001) noted that their practices tended to converge towards a similar mix, both because ‘conventional’ farmers evolved towards more knowledge-based practices, and because after early changes in

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