NJAS - Wageningen Journal of Life Sciences 64–65 (2013) 95–103

Contents lists available at SciVerse ScienceDirect

NJAS - Wageningen Journal of Life Sciences

journal homepage: www.elsevier.com/locate/njas

Review

Designing the emerging EU pesticide policy: A literature review

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ARTICLE INFO

Article history:
Received 11 April 2012
Accepted 18 September 2012
Available online 22 October 2012

Keywords:
Pesticides
Elasticities
Policy design
Production function

ABSTRACT

A European Union (EU) wide pesticide tax scheme is among the future plans of EU policy makers. This study examines the information needs for applying an optimal pesticide policy framework at the EU level. Damage control specification studies, empirical results from pesticide demand elasticity, issues on pesticide risk valuation and uncertainty, and knowledge on the indirect effects of pesticides in relation to current pesticide policies are analysed. Knowledge gaps based on reviewing this information are identified and an illustration is provided of the direction future pesticide policies should take.

Contents

1. Introduction

The past decades have witnessed a considerable increase in the global production of agricultural goods and services. Plant protection products have played a major role in driving this growth, as have other technological innovations. However, the excessive use of inputs like plant protection products has a concomitant impact on the environment.

Plant protection products are active substances that enable farmers to control different pests including weeds, and thus constitute one of the most important inputs in agricultural production [1]. There is a large range of positive outcomes from the use of different pesticides related to improving crop yields and the quality of production resulting in increased farm and agribusiness profits. With weeds being the major yield-reducing factor for many crops, herbicides are the most widely used type of pesticides. Cooper and Dobson [2] refer to a number of benefits from pesticide use, among which are (1) the improved shelf life of produce, (2) the reduced drudgery of weeding, which frees labour for other tasks, (3) reduced fuel use for weeding, (4) invasive species control, (5) increased livestock yields and quality, and (6) garden plant protection.

The publication of Rachel Carson's *Silent Spring* [3], which highlighted the risks of pesticide use, stimulated the steady progress in documenting the negative spillovers arising from the continuous use of chemical inputs [4–8]. Pesticides are not restricted to use in agriculture: they are used frequently for landscaping, maintaining sporting fields, for road and railway side weed control, and public building maintenance. These substances can be dangerous for human health when the degree of exposure exceeds the safety levels. Exposure can be direct, for example when farm workers apply pesticides to various crops, and indirect when consumers ingest agricultural products that contain traces of the

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1573-5214/$ – see front matter
http://dx.doi.org/10.1016/j.njas.2012.09.001

chemical, or even when bystanders happen to be nearby application areas.

Additionally, the excessive and uncontrolled use of pesticides can pose serious and irreversible environmental risks and costs. The decline in the number of beneficial pest predators has led to the proliferation of various pests and diseases with adverse impacts on fauna and flora [5]. Certain pesticides applied to crops eventually end up in ground and surface water. Sharpley et al. [6] note that pesticides play an important role in the pollution of surface water. Pesticides have toxic effects on humans, livestock and wildlife [7] while among the risks they pose are pesticide residues in food, water, and soil, harm to agro-ecosystems, adverse effects on target biota, and pest resistance [8]. Pesticide-resistant weeds and pests can trigger increased pesticide applications to reduce the damage, resulting in higher economic costs that farmers must shoulder.

The individual EU member countries and the European Commission (EC) have a long history of controlling pesticide use through a myriad of country-specific programmes. Pesticide policies were first introduced at EU level in 1979. The directives 91/414/EC and 98/8/EC on the placing of plant protection products and biocidal products on the market were the first ones dealing with the authorization of pesticides. The waste framework directive (2006/12/EC) and the directive on hazardous waste (91/689/EEC) constitute regulations impacting pesticide use in many ways, as they establish provisions for the safe collection/disposal of empty pesticide packages and unused or expired pesticides. The water framework directive (2000/609/EC) and the regulation on MRLs (396/2005) address pesticide residuals, where the first identifies substances that are hazardous for water (including active substances in plant protection products) and the second sets maximum residue levels of active substances in food and feed. The Thematic Strategy on the Sustainable Use of Pesticides completes the overview of the existing pesticide regulations, as it aims to regulate pesticide use. Regulation No. 1107/2009 concerning the placing of plant protection products on the market and directive No. 2009/128/EC on the sustainable use of pesticides are due to replace directive 91/414/EC. Among the future goals are the establishment of quantitative reduction targets and the introduction of tax schemes.

Many EU member states show an increase in the sales of pesticides over the period 2002–2008 (e.g., the Netherlands 33%, Germany 17% and Denmark 39%) [9]. The increase in pesticide use and the continuous presence of pesticides in aquatic environments in conjunction with the fact that the current pesticide regulatory framework does not sufficiently address the actual use-phase of pesticides has led the EU to consider an overhaul of the pesticide regulations [10]. The upgrade of existing pesticide regulations includes the introduction of an EU-wide regulatory framework on pesticides, grounded upon economic incentives. The foundation of future EU policy schemes aims at the sustainable use of pesticides in European agriculture. This effort involves reducing the risks and impacts of pesticide use on human health and the environment, while still being consistent with crop protection. The design of optimal pesticide policies requires insight into the relationships between production decisions on crop yields and their quality, the environmental and health spillover impacts of pesticide use, and how policies and regulations influence production decision-making. A key policy consideration is balancing the incentives for economic growth against the adverse impact on the environment, which is broadly defined to include the management of land, water and air, as well as the overall stability and biodiversity of the ecological system.

The objective of this paper is to explore the potential for introducing an optimal pesticide policy at EU level from an economic point of view. The paper contributes to the literature by reviewing the information needed for the introduction of such a policy framework and by identifying knowledge gaps to be addressed in support of an optimal pesticide policy design. The remainder of the paper is organized as follows. The next section presents an optimal pesticide policy framework. This is followed by a review of the existing literature on pesticides that indicate the extent to which the current literature provides information needed for the implementation of optimal pesticide policies. The final section discusses knowledge gaps based on the literature review.

2. An optimal pesticide policy framework

Under the Pigouvian tradition, the optimal pesticide policy grounded on economic incentives should include taxes (or subsidies) to control pesticide externalities, where the tax (or subsidy) reflects the marginal net damage (benefit) of pesticide use. The problem with such a policy framework is that obtaining an accurate estimate of the monetary value of pesticide damage (or benefit) is not an easy task, mainly because of prohibitive information requirements. Alternatively, Baumol and Oates [11] proposed the establishment of a set of standards or targets for environmental quality followed by the design of a regulatory system that could employ taxes (or subsidies) to attain these standards. The authors add that although this will not result in an optimal allocation of resources (such as pesticides) it represents the most cost effective way in attaining the specified standards. A pesticide policy framework that combines market-based instruments with standards for acceptable environmental and health quality will enable policy makers to base the charge rates or prices on the acceptability standards rather than on the unknown value of marginal net damages [12–14].

The design and application of a pesticide policy framework grounded on market-based instruments and environmental and/or health standards, requires rigorous information on different dimensions and aspects of pesticide use. The elements needed by policy makers to apply such a policy framework may be summarized by information on (1) the production structure (i.e., production function, pesticide demand elasticities), (2) attitudes towards risk and uncertainty related to pesticides application, (3) the value of pesticides to consumers (e.g., the willingness to pay (WTP) for lower pesticide use), and (4) the indirect effects of pesticide use. Information on the production structure of pesticide use includes trends in pesticide use (overuse or underuse), and the direction and extent farmers' behaviour will change following the introduction of a pesticide tax. In particular, will a pesticide price increase lead to significantly decreased pesticide use? Information on the riskiness of pesticides in relation to output realization may enhance the effectiveness of pesticide policy tools while evidence on the consumers' WTP for reducing pesticide-adverse effects can reveal if there is a demand for more environmental friendly products. So policy makers may use this information by providing an incentive to farmers to switch to more environmental friendly forms of production (e.g., organic or Integrated Pest Management[1] (IPM)). Finally, detailed data on the indirect effects of pesticides can assist policy makers in setting proper environmental and health standards that can increase the effectiveness of the different economic instruments.

It is important to note that optimal pesticide use may be attained not only through the use of market-based instruments, such as taxes and subsidies, but also of alternative instruments. For instance, command-and-control regulations may be among the means to reach a policy goal. Unlike market-based instruments that encourage firms' behaviour through market signals,

[1] The Food and Agriculture Organisation [94] defines IPM as "an ecosystem approach to crop production and protection that combines different management strategies and practices to grow healthy crops and minimize the use of pesticides."