Comparative impact of insecticide treatments on beneficial invertebrates in conventional and integrated farming systems

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INTRODUCTION

Integrated farming is seen as the way to reduce pesticide use in arable crops whilst maintaining profitability and protecting the environment. The LINK Integrated Farming Systems project was initiated firstly to develop an integrated system for arable rotations and secondly to compare this system with conventional practice. Located at six sites, a range of climatic zones, soil types and agronomic practices are represented. The project is now in the final year of a five-course rotation of cereals, break crops and set-aside. A minimum of seven pairs of plots (minimum area of 2.5 ha and 70 m width) per site ensured that each course of the rotation was present every year. Economic, agronomic and environmental factors were investigated and invertebrates were used as environmental bio-indicators, because they have been shown to be responsive to many farming practices. Furthermore, their encouragement is an essential component of integrated farming, where invertebrates can be important predators of crop pests.

Ecotoxicology: Pesticides and beneficial organisms.
In the current economic climate of high crop values and arable area aid, there appears to be little incentive for farmers to reduce inputs which directly influence yield or quality. However, other farming system projects have demonstrated that integrated farming can be equally or more profitable than the conventional practice (El Titi, 1991; Jordan and Hutcheon, 1995). If integrated farming is to be widely adopted, it is essential to demonstrate the environmental benefits and to present these with the potential economic risk to the farmer of adopting such a system. With respect to integrated pest management, it may take several years for predatory and parasitic species to reach sufficient levels to supply acceptable levels of biological control. Therefore, ensuring that pesticide inputs are only applied when necessary would appear to be essential.

The impact of insecticides on beneficial invertebrates may be influenced by the spectrum of activity of the active ingredient, the spray distribution, the type and growth stage of the crop, and the invertebrate species and their phenology. In addition, diurnal activity is important in determining exposure and may be used as a management tool. The intensity of insecticide treatments may also prolong the effect by preventing recovery through breeding or re-invasion.

The LINK IFS project provides the opportunity to examine insecticide effects under current spray regimes as in the conventionally farmed plots, as well as allowing comparisons with the lower inputs on the plots farmed using an integrated system. The effect of insecticide treatments can also be examined with respect to other farming practices that may influence invertebrates. Each of the major arable crops will be discussed with respect to their insecticide inputs and their impact on non-target invertebrate species will be appraised using invertebrate data from four of the LINK IFS project sites.

ASSESSING THE RISK

Cereal crops

Insecticides are most commonly applied to cereals in the autumn to prevent the transmission of barley yellow dwarf virus (BYDV) by aphids. Early sown crops are most vulnerable; therefore in the LINK IFS project wheat crops are drilled later, after mid October, to avoid the main aphid immigration period. There is a yield penalty for this practice and a risk for the farmer that adverse weather may prevent drilling or that deteriorating soil conditions may result in poorer crop establishment, consequently increasing vulnerability to slugs. In comparison, insecticide costs are small and often the application cost is low as the insecticide is usually applied with a herbicide (Oakley, 1994). Moreover, fewer invertebrates are active in late autumn compared with the summer (Den Boer