BREEDING SUCCESS AND RISK ASSESSMENTS FOR BIRDS EXPOSED TO TREATED SEED

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Abstract

Crop seeds may be treated with pesticide prior to drilling to protect from pests and disease. Treated seed may, however, be attractive to farmland birds as a food source; as such these uses are subject to an ecotoxicological risk assessment prior to approval, in accordance with Council Directive 91/414/EEC and Regulation (EC) 1107/2009. Reproductive risk assessments for treated seed have a relatively high 'failure' rate (Toxicity-Exposure Ratios <5). Under field conditions, however, factors such as extent of exposure during breeding, toxicity profile of the seed treatment, multiple broods and landscape may influence likely effects on populations of farmland birds. This project seeks to provide, for selected granivorous bird species potentially exposed to treated seed, estimates of breeding success and population growth rate (PGR) through integration of onset of breeding, timing of drilling of treated seed, toxicity profile and over winter survival. Alongside this, the potential to include crop cover in estimates of exposure at the population level will be investigated, and a discussion provided on the use of PGR in regulatory risk assessments.

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Objectives

- Develop population growth rate estimates for Skylark potentially exposed to treated seed.
- Develop population growth rate estimates for Rook potentially exposed to treated seed.
- Screen Linnet and Yellowhammer for effects on breeding success in key spring crops for which data of sufficient resolution exist.
- Explore the mechanisms by which crop cover can be used to estimate exposure to birds. This Objective will aim to define how land cover may be used to determine exposure at the local or regional population level. This is considered a key objective in adding ecological realism to future population level assessments. It is likely that the processes will vary between species.
- Discuss the potential use of breeding success and population growth rate (PGR) in regulatory risk assessments.

The project uses data from the UK, and therefore focuses on spring crops, but in principle could be applied to any region.

Timing of breeding varies between species and may influence exposure to treated seed.

Data

The project uses a variety of data:

- Timing of drilling of spring crops is provided by ADAS and FERA Pesticide Usage Survey (e.g. Figure 1) .
- Onset of breeding, egg & nestling survival, adult overwinter survival is provided by the British Trust for Ornithology (BTO).
- Land cover data is provided by the DEFRA Agricultural census.

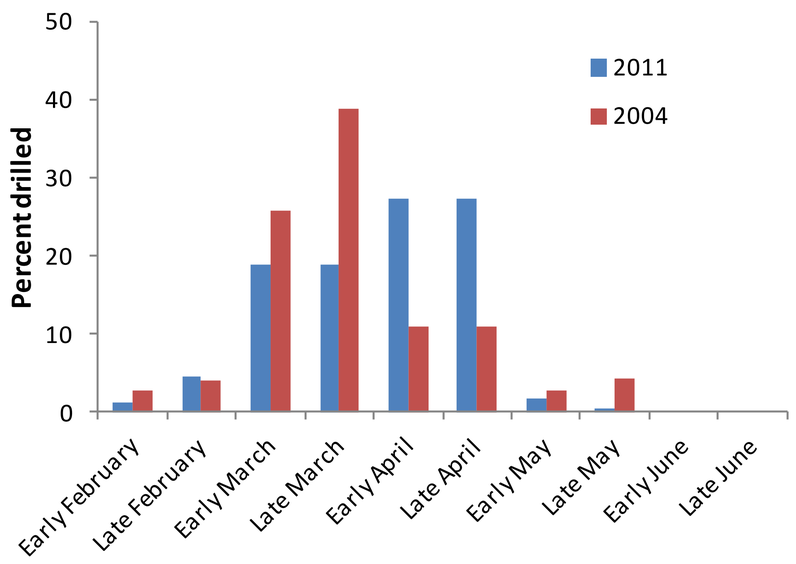

Figure 1. Timing of spring barley drilling, UK. Comparison of data for 2004 and 2011. Data: ADAS.

Figure 1 illustrates significant between year variability in the amount of spring barley drilled in April. This month represents the onset of breeding for certain granivorous focal species. Exposure rates may therefore vary between year. The project will account for this variability through sampling of drilling data collected over 10 years.

Methods

- Many bird species may raise several broods within a season. First egg dates taken from the BTO Nest Records Scheme may include first eggs of second or third clutches. We used information about duration of different breeding phases and Mayfield estimates of the daily probability of survival to derive a single cohort of Skylark that could give rise to observed distribution of nests.
- Birds progress through the breeding season using Markov transition matrices. The probability of progressing onto the next day of breeding is given by the background daily mortality of broods and exposure to pesticide.
- Drilling date is sampled from a distribution (data collected over period of 10 years).
- For birds exposed to treated seed, the date of drilling, seed loading and toxicity profile of the seed treatment result in an individual TER. If the TER is in excess of the trigger of 5, this leads to brood failure.
- If a brood fails due to natural causes (as indicated by background mortality) or pesticide (TER <5), females enter a 7 day recovery period before recommencing reproduction.
- Dietary information (proportion of diet taken from treated area, PT; proportion of potentially contaminated food item in diet, PD; dehusking, DH) are not considered (but could be); the project will investigate whether crop cover can be used to inform exposure at the population level.

Preliminary results

The work is ongoing. The following assumptions apply to the example results shown in Table 1:

- Seed treatment DT_{50} of 1.35 d and 10 d (comparison to default)
- TER <5 would result in brood failure. In reality, the meaning of the trigger value of 5 is uncertain.
- PT, PD, DH = 1.
- Toxicity profile – primary effect on survival of nestlings to day 14.
- Drilling dates were randomly sampled in Monte Carlo models from a distribution of drilling dates for spring barley in the UK averaged across a 8 year period from 2004-2011.

Table 1. Example results for Skylark and treated spring barley. Results shown were generated during method development, and should not be used in regulatory submissions.

Parameter	Control	DT_{50}=1.35	Percent of control	DT_{50}=10	Percent of control
Chicks raised per female	3.1659	3.1375	99.10	2.9356	92.70
Broods started	330.27	330.75	100.10	335.99	101.70
Percent broods success	29.94	29.63	99.05	27.72	92.59
Percent broods fail (natural)	70.06	69.72	99.54	67.92	96.95
Percent broods fail (pesticide)	0.00	0.65%	-	5.94	-

Interpretation

- Background mortality is high.
- Seed loading has a clear influence on exposure, and an impact on brood success.
- These results do not yet show the effect of varying drilling date (full drilling data were not used).
- These results do not yet show the consequences on breeding success of pesticides which affect different breeding phases.