

Risk assessment and state of art on the risk for honey bees from dust drift of insecticidal dusts during sowing

Risikobewertung und Stand der Forschung zum Risiko für Honigbienen durch die Abdrift insektizider Stäube während der Aussaat

Jens Pistorius^{1,*}, Pablos-Theodor Georgiadis, Matthias Stähler², Kristin Schwabe³, Udo Heimbach¹

¹ Julius Kühn-Institut, Institute for Plant Protection in Field Crops and Grassland, Braunschweig, Germany

² Julius Kühn-Institut, Institute for Ecological Chemistry, Plant Analysis and Stored Products Protection, Berlin, Germany

³ now State Institute for Agriculture, Forestry and Horticulture Saxony-Anhalt, Bernburg, Germany

* Corresponding author, jens.pistorius@jki.bund.de

DOI 10.5073/jka.2014.444.023

In 2008 a large-scale honey bee poisoning in parts of southern Germany occurred during sowing of maize, caused by contamination of flowering bee forage plants with drift of dust from insecticidal seed-dressing containing the active substance Clothianidin.

Since early 2009, drift experiments during sowing insecticide treated seeds were realized to investigate the relation between abrasion potential of treated maize and oil seed rape seeds (determined by Heubach dustmeter, dust drift and resulting residues in Petri dishes on bare soil in the off crop area placed at different distances and in adjacent flowering crops as well as residues in bee matrices and the effects on honey bees. In "worst case" scenario experiments bee colonies were set up in semi-field (gauze-covered tents, 16 x 6 m) and in field trials along the edges of the drilled area to study the impacts on mortality, foraging activity and brood development of bee colonies following exposure to dust drift during sowing and exposure to contaminated pollen and nectar.

Using drift-reduced pneumatic sowing techniques, several trials with drilling of seed treated crops was conducted during bee flight activity, so foragers of the field trials were continuously exposed to dust. Control variants were set up with hives in about 50 m (control) and more than 500 m (remote) distance to the drilling area. In semi-field trials, the hive entrance of colonies were closed before daily bee flight activity and the gauze covering removed before drilling; afterwards the tents were covered with gauze again and the hives opened. Furthermore, in cooperation with a contract lab that developed new machinery that allows the application of defined amounts of dust, a field trial was conducted. A number of different experimental approaches were conducted in the last few years, some also by other research groups. Some suitable test methods were identified to assess the effects of contaminated dusts on bees for risk assessment purposes.

From the available data, conclusions on the potential exposure of bees to dust following sowing of different seed treated crops, on the potential crops of concern and the importance of different exposure routes as well as the different factors influencing the exposure can be drawn. Nevertheless, the residues which bees can be exposed to during or following a sowing operation is highly variable and depends on the quality of seed treatment, the sowing machinery used, on the size of the sown area, on the attractiveness and quantity of nectar and pollen of the vegetation in the margin of the field sown and on meteorological conditions. To allow an estimation of potential dust exposure for risk assessment purposes, it is important that quality criteria are defined and guaranteed for the seed treatment of different crops and also for sowing machinery including devices for drift reduction e.g. deflectors. With these prerequisites, reliable exposure values can be obtained.

As sowing of different crops results in different exposure, also the potential risk for bees differs. In semi-field and field trials with sowing of winter oil seed rape no adverse effects on honey bees were observed if the seed treatment and sowing technique guarantee a limited dust emission. Since 2008, clear improvements in seed dressing quality of maize and development of drift-reducing sowing technique were achieved, resulting in a significant reduction of the potential dust exposure. Still,

trials with sowing of maize treated with bee toxic insecticides with improved seed treatment quality (e.g. Heubach value of less than 0.5 g/100,000 seeds and approximately 20% a.i. Clothianidin in the dusts), resulted in a high mortality of exposed bees and underline the necessity of further improvements of seed treatment quality and a reduction of potential dust emission during sowing of maize to exclude adverse effects on bees.

The project was partly funded by the German Ministry of Food, Agriculture and Consumer Protection (BMELV) within the German Diabrotica research program.