

Dust drift during sowing of maize and oilseed rape effects on honey bees

Abdrift während der Aussaat von Mais und Raps – Auswirkungen auf Honigbienen

**Pablo-Theodor Georgiadis^{1*}, Jens Pistorius¹, Udo Heimbach¹, Matthias Stähler²,
Kristin Schwabe³**

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, pablo.georgiadis@jki.bund.de

DOI 10.5073/jka.2014.444.022

In 2008 bee poisoning incidents in southern Germany revealed drift of insecticidal dusts on adjacent areas with flowering bee forage plants during sowing of maize as a considerable route of exposure. Consequently, several improvements have been proposed as possible risk mitigation measures e.g. for seed dressing quality regarding dust abrasion, taking into account Heubach values and residue content of dust. To assess potential effects on honey bee colonies following insecticidal dust drift on adjacent non-target areas, from 2009 until 2012 several large-scale drift experiments were carried out during sowing treated maize and winter oil seed rape (= WOSR) using different seed batches.

In drift experiments with maize, two different set-ups were used: 2010 the experimental area (flowering WOSR) was in the middle of two areas reserved for maize drilling depending on wind direction. In contrast, 2011 and 2012 the area reserved for drilling of maize was surrounded by flowering WOSR areas.

In 2010, on both sides directly along the edge of the WOSR 4 bee hives for the field approach as well as three gauze-covered tunnel tents (16 x 6 m) with bee hives for the semi-field approach were exposed. For "Treatment"-variant of the field and semi-field approach the hives were set up at 0 respectively 3 m and for "Control"-variant at 90 respectively 87 m from the edge of the directly exposed WOSR (= 0 m). For the field approach another 4 hives were set up in about 800 m distance. Before sowing, semi-field colonies were closed and the gauze from the tunnels removed. After sowing, the tents were covered again and the hives reopened. Bee hives in the field approach were left open during the drilling process, so forager bees were continuously exposed to contaminated dust. In 2011 and 2012, similar experiments with field and semi-field approach were performed (distances to the exposed side of WOSR of 0 m, 50 m and in the field set-up, an additional group of colonies at a distance of about 500 m).

In all experiment, maize seed was sown by a pneumatic vacuum operated precision air planter with at least 90% drift reduction due to a deflector.

In drift experiments with WOSR 2009 and 2011, the drilling area was surrounded by flowering mustard. Sowing was done by a conventional pneumatic seed drill. Experimental procedures, samplings and documentation were similar to the drift experiments with maize in 2011. Only in 2009, the design of the semi-field approach differed in tent size (4 x 4 m) and number of replicates (n=4).

The impact of dust drift on bee colonies in semi-field and field approaches were examined by assessing flight activity and mortality in dead bee traps (type "Gary"). Dead bees were documented, collected, frozen and analyzed for residues.

The results of drift experiments during maize sowing showed a clear treatment related increase of bee mortality, especially in the worst-case semi-field approach, but also in the field approach at a much lower level. Bee mortality in 2011 was slightly lower than in 2010, presumably due to a slightly lower exposure (2010: 0.091 g Clothianidin in Heubach filter dust of 100,000 seeds applied/ha; 2011: 0.086 g a.i. in Heubach filter dust of 100,000 seeds applied/ha). A very similar mortality rate compared to control was found during maize sowing in 2012 (0.041 g a.i. in Heubach filter dust per amount of seeds applied/ha). Further improvements of the seed treatment quality of maize and of

the sowing technique are needed to exclude adverse effects on bees.

In contrast to sowing maize, during sowing of treated WOSR in 2009 and 2011, no treatment related increase of mortality was observed. Even in the «treated» variant of the worse-case semi-field approach, only low mortality, similar to the control was detected, barely exceeding the natural rate of mortality. The amounts of abrasion dust and its insecticidal residue content were clearly lower compared to maize (2011: 0.021 g a.i. Clothianidin in Heubach filter dust per amount of seeds applied/ha). The good seed treatment quality of WOSR and the use of a conventional pneumatic seed drill did not result in any 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.