Notes and Comments on CDRC Study Reports - David L. Fischer (22 July 2016)

Ohio State University Report

1) Seed Treatment Quality

The executive summary begins with a photograph of a corn seed with a large amount of the seed coating abraded. This image is repeated in the main body of the report as an example of what planted corn seeds "typically" look like after passing through a planter. Is this image really of a typical case? It appears to have 30-50% or more of the seed coating removed. Earlier, I distributed to the CDRC Steering Committee photos taken by Bayer CropScience of neonicotinoid treated seeds before and after passing through a John Deere vacuum meter unit. These seeds did not show any appreciable difference before and after simulated planting. The Ohio State photos therefore raise questions about whether the seeds tested in the OSU dust drift studies were properly treated or otherwise atypical. For example, it would be expected that product efficacy would suffer if a large amount of the seed treatment was removed prior to planting. This hasn't been the case with commercial use of seed-treated corn.

Some measurements of the amount of active ingredient coming off treated corn seeds were made in past years by Art Schaafsma's team at the Univ of Guelph. In the CDRC report of the 2014 research, I found the following statement:

> "Planter exhaust emitted 0.75 mg of neonicotinoid active ingredient per 100 m of row (single row) on average."

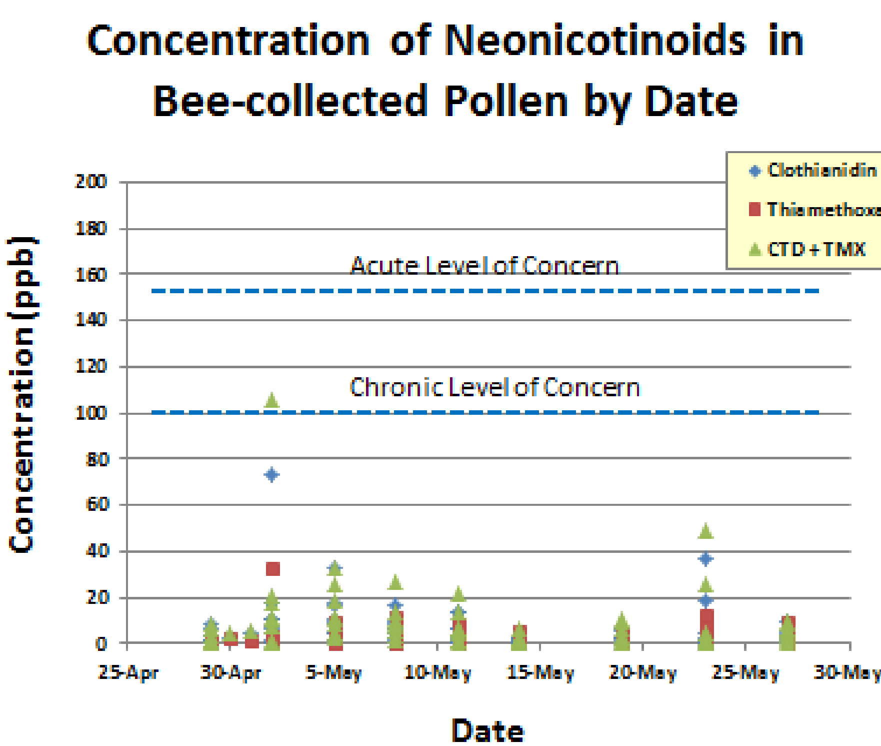
What percentage of the active ingredient on the seeds planted in 100 m of row would 0.75 mg represent?

The seeds planted in this study (U of Guelph in 2014) generally were treated at the rate of 0.25 mg of neonicotinoid per seed. They were planted at a rate of 34,000 seeds per acre, which in the case of 30 inch row spacing typically used, works out to 640.2 seeds per 100 m of row. The total amount of active ingredient on seeds planted in 100 m of row is therefore 0.25 mg per seed * 640.2 seeds = 160.05 mg. So if the average planter exhaust for 100 m contained 0.75 mg of active ingredient, this represented 0.47% of the total active ingredient applied (planted) per 100 m of row.

So according to the U of Guelph 2014 study, the planting process removed a very small percentage, the average being about 0.5%, of the active ingredient originally present on treated seeds. This is strikingly different from what the photos of the seeds from the OSU study show. Instead of 0.5% loss of the seed treatment, these figures seem to show loss of nearly 100 times more. More research may be needed to explain the difference in results between U of Guelph and OSU, and to characterize typical loss rates of active ingredient from treated seeds. The seed treatment industry has put in place the Heubach test as the standardized method to determine how much of the seed coating is likely to be removed as a result of mechanical abrasion during planting activity. It would have been extremely helpful to have Heubach tests performed on the batches of seeds used in the OSU study to see if the source seeds met the industry standard. However, this appears not to be possible since only seeds left over after the planting process have been saved—no samples of seeds were collected pre-planting. So the quality of the seed treatment of the seeds used in the OSU study is an uncertainty. Given this uncertainty, I would suggest that the photographs of abraded seeds be removed from the report, or at least a clear statement made that indicates the quality of the treatment of these seeds is unknown.

2) Neonicotinoid concentrations in bee-collected pollen were greater during the corn planting period than at other times. The OSU report states that "clothianidin and thiamethoxam residues are reliably detected at elevated levels (8 ppb above background on average) in honey bee-collected pollen harvested during during corn planting. I would suggest that the word "elevated" be deleted and the sentence and the sentence changed to read ".., at levels averaging 8 ppb above background in bee-collected pollen harvested … " .

The report should also explain what the levels in bee-collected pollen mean in terms of risk. I would suggest a figure be added showing residue measurements in comparison to acute and chronic levels of concern for neonicotinoids. For example, see the figure below.



The figure above was prepared using the data provided in the OSU report and follows the approach used by EPA in their recently published pollinator risk assessment for imidacloprid. In that document, the Agency plotted all field measurements of residue levels in comparison to levels of concern derived from toxicity benchmarks. The acute level of concern has been defined by EPA to be a dose level accumulated over a single day equal to 40% of the LD50 dose. For clothianidin the LD50 is 3.7 ng/bee, and therefore 40% of the LD50 is 1.48 ng. What concentration in pollen would result in ingestion of 1.48 ng. EPA's Tier I model (BeeREX) assumes the worst-case pollen consumption rate for adult honey bees is 9.5 mg of pollen per day (attributable to nurse bees). In order for an individual bee to accumulate 1.48 ng via ingestion of pollen, the concentration in the pollen would need to be 1.48 ng/9.5 mg = 0.156 ng/mg which is equivalent to 156 ng/g which is equivalent to 156 ppb. A similar calculation can be made for thiamethoxam, and the LOC would be shown to be slightly higher. To be conservative, only the acute LOC for clothianidin (156 ppb) is included in the figure. EPA has not yet determined a chronic LOC for pollen consumption by honey bees ingesting clothianidin or thiamethoxam. However, EPA has established a chronic LOC of 100 ppb for consumption of pollen containing imidacloprid. Imidacloprid has a similar toxicity to honey bees to clothianidin and thiamethoxam, and therefore one might expect the chronic LOC of these compounds to be also approximately 100 ppb. Therefore, this value (100 ppb) is plotted as the chronic LOC in the figure above.

Taking into account the estimates of the acute and chronic LOCs, the measured levels of clothianidin, thiamethoxam and total of these two neonicotinoids combined, that were made in the OSU study are shown to be typically far lower (see Figure above). Only one measurement on one sample date had a concentration that exceeded the chronic LOC, and all measurements were below the acute LOC. The clear conclusion is that the levels of clothianidin and thiamethoxam measured in bee collected pollen were generally far below toxic threshold levels. The residue levels measured DO NOT indicate any appreciable risk to honey bees, and DO NOT explain the acute mortality observed in the study.

The above analysis should be included in the report. Without it, the reader might mistakenly think that the residue measurements DO explain the mortality observed.

There was a correlation between the number of dead bees recorded in dead bee traps and the residue levels in bee collected pollen. But this does not mean that any bees died from ingesting pollen. Rather, I think the more likely explanation is that some bees died as a result of ingesting dust particles directly either incidentally or from social grooming, and that such events tended to occur at the same time when residues in pollen tended to be higher.

3) During corn planting, bee mortality increased by a factor of 2.3 based on counts of dead bees within drop-zone dead bee traps placed in front of hives near corn fields in central Ohio. However, there was no detectable change in colony strength as a result of this effect. Nor was

there any indication of a delayed or long-term effect on colony viability, including overwintering survival. The overall conclusion is that exposure to seed treatment fugitive dust results in a level of mortality of adult honey bees that generally does not harm the functioning or viability of the colony. Many standard beekeeping practices, even opening a hive, removing frames for inspection and putting them back, will result in some bee mortality that is detectable in daily observations of dead bee trap counts. The dead bee trap counts, while elevated during corn planting periods, were not of sufficient magnitude to suggest significant mortality events occurred in the OSU study hives. An average of 30 extra dead bees per day for 10 days was typically observed. This is far below the level that would qualify as a bee kill of biological significance according to Johansen and Mayer's *Pollinator Protection: A Bee and Pesticide Handbook* (1990) which lists up to 100 dead bees per day in a Todd dead bee trap as a normal die-off, 200-400 as a low kill, 500-900 as a moderate kill, and 1000 or more as a high kill. It is important that the CDRC report emphasizes that the level of mortality documented in this study was low, and had no observed effect on colony development or viability.

4) The authors did not identify any landscape factors, such as presence of flowering plants in or around cornfield sites that correlated with dead bee trap counts or contamination levels of neonics in bee-collected pollen. This suggests that vegetation management (elimination of flowering weeds, etc.) is unlikely to be effective at reducing risk to bees. However, this finding needs to be considered speculative, because the risk to bees was very low regardless of the landscape conditions in this study.

5) The measurements of neonic levels in "Krupke tower" samples of dust moving off-site during planting were higher than measurements made by Art Schafsma at U of Guelph, or Bayer-Syngenta studies. It is not yet clear why this was the case. The seed treatment quality of the seeds planted in the Ohio State trials was not measured with a Heubach test, and based on the photographs may have been poor. Regarding the comparison of fluency agent to conventional lubricants, the number of trials is limited, the source of treated seeds is poorly documented, the application of the lubricants was not well controlled, and the planter types were variable. There appear to be only four trials in which a direct comparison could be made between use of the fluency agent and conventional lubricants. These are trials 1, 2, 3 and 8. In 3 of these trials, the use of fluency agent appears to have been effective at reducing the amount of a.i. released (see Fig. 8). In one trial (Trial 3) an opposite result was obtained. However, the number of trials is too few to draw the definitive conclusions, and certainly the data do not justify the suggestion that the fluency agent is not effective at reducing bee exposure to contaminated dust during planting of treated seeds.

6) Given the variability of planter types and other conditions of the trials, it is difficult to draw any conclusions from these trials about the effectiveness of the Bayer Fluency agent vs conventional lubricants. However, Figure 6 seems to show a reduction in median or average levels of active ingredient in dust reaching dust collectors (Krupke towers). The authors state there is no

apparent difference, but the data as presented in Figure 6 show a clear difference in the central tendency (middle quartile of the data) of the respective data.

7) Figure 10, showing the photos of seeds with a large amount of the seed treatment eroded as a result of planter abrasion is problematic. There are no data backing up the statement that the photo on the left represents a typical seed after passing through a planter. Also, the amount of a.i. remaining on the seed hasn't been determined. These photos have the potential to mislead the reader regarding the amount of a.i. lost due to dust abrasion. These photos should be deleted from the report.