Julius Kühn-Institut
Bundesforschungsinstitut für Kulturpflanzen
Federal Research Centre for Cultivated Plants

Routes of exposure for bees and pesticide risk assessment

Bee poisoning incidents and international activities to protect pollinators

Dr. Jens Pistorius

Programa de conferencias

- *Miércoles 6 de febrero* a las 17 hs
  “Pesticides and risks to bees” en Facultad de Química

- *Jueves 7 de febrero* a las 17 hs
  “Pesticide testing methodologies for bees” en IIBCE

- *Viernes 8 de febrero* a las 16 horas
  “Routes of exposure for bees and pesticide risk assessment” en Facultad de Química
- *Viernes 8 de febrero* a las 17.15 horas
  “Bee poisoning incidents and international activities to protect pollinators”

- *Lunes 11 de febrero* a las 10 hs
  - **“Bees and beekeeping ”** en INIA (a definir)

Institute for Bee Protection

Tasks related to:

Plant Protection Products (PPP)

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I. Risk assessment of plant protection products/bees

II. Examination center for bee poisoning incidents

III. Research on risks of pesticides to bees





www.jki.bund.de

Concerns- bees/pesticides

- Incidents
- Weakening of colonies
- Overwintering capacity
- Fitness and disease resistance
- Both short-term and long-term
- Lethal (and „relevant“ sublethal) effects

What is done in a Risk assessment procedure to cover concerns on bee health, bee mortality, colony and brood development, sublethal and lethal effects (etc…) ?

Risk **management** authority→

Bundesamt für Verbraucherschutz und Lebensmittelsicherheit

National/zonal registration

Risk **assessment** authorities: JKI, UBA, BFR

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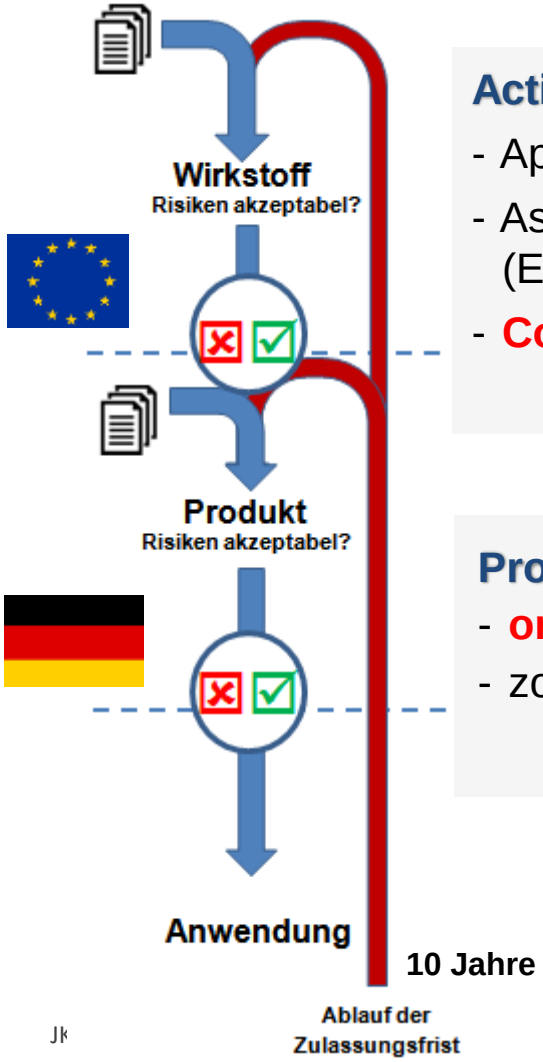
Commercially used pollinators (Honeybees, Bumblebees, Solitary Bees)	Risk for Health	**Wild living Bees**

Risk assessment of pesticides in the EU:

Active substance

Assessment acc. to EU Legislation No. 283/2013 and No. 284/2013



Active substance assessment

- Approval on EU level by EU Commission
- Assessment by EU-member states + EFSA (European Food safety Authority)
- **Concept of one safe use**

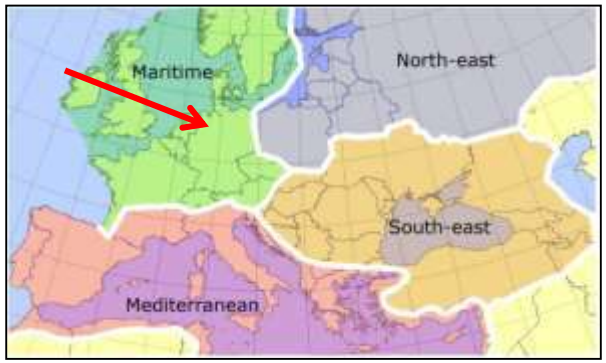
Product assessment

- **only possible if active substance is registered in EU**
- zonal registration (3 Zones in EU)

Risk assessment of pesticides in the EU:

Plant Protection Product

Zonale Zulassung nach EU-VO (EG) Nr. 1107/2009



Klimatische Zonen

Zonal Assessment

One EU-MS (**zRMS**) **makes assessment for own country and all other countries of the zone**).

Product Assessment

- Assessment conclusion BINDING for all other MS
- Other optinions and National specific issues can only be argued with very hard data

Zonen der zonalen Zulassung

Zone A North: Dänemark, Estland, Finnland, Lettland, Litauen, Schweden

Zone B Middle: Belgien, **Deutschland**, Irland, Luxemburg, Niederlande, Österreich, Polen, Rumänien, Slowakei, Slowenien, Tschechische Republik, Ungarn, (Vereinigtes Königreich)

Zone C South: Bulgarien, Frankreich, Griechenland, Italien, Malta, Portugal, Spanien, Zypern

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Risk assessment- legal framework (EU)

Legal framework:

Directives:

- Directive 91/414/EEC (Annex II point 8.3.1.1, Annex III point 10.4)

  Where there is a possibility of honeybees being exposed, no authorization shall be granted if the hazard quotients for oral or contact exposure of honeybees are greater than 50, unless it is clearly established through an appropriate risk assessment that under field conditions there are ***no unacceptable effects on honeybee larvae, honeybee behaviour, or colony survival and development*** *after use of the plant protection product according to the proposed conditions of use.*

- Directive 91/414/EEC (Annex VI point 2.5.3.2)

Guidance documents:

- Sanco 10329/2002 rev 2 chapter 4
- New Sanco guidance document in preparation for seed treatments
- EPPO 170
- EFSA Guidance document – not (yet?) in force

Guidelines:

- Test guidelines OECD EPPO PP 170 (4) (especially semi-field and field set-up)
- EPPO 170 risk assessment scheme - also „only“ published or additional, established protocols have been requested by authorities

Risk assessment needs surrogate species

- Honey bees: manageable species, Pros and cons for RA
- Studies with honey bees well established for ~a century, many specific tests available
- Other bees have a different, highly variable biology
  - Some may be more sensitive - but is exposure the same?
  - Smaller flight range – effects different than honey bees?
  - Most wild bees in Germany are solitary and unmanaged
  - no communication of nice forage to other bees→ Exposure may be critical for those directly adjacent to a treated field while population in the area maybe relatively unaffected

→ To which extent is the honey bee a suitable surrogate species?

Individual bees and the whole colony may be influenced by pesticides

Numerous aspects make out of a number of bees a highly complex superorganism with many factors that influence the wellbeing of bees and the „success“ of a bee colony, e.g. (but not limited to:)

- Mortality, fitness and longevity of bees, Functionality of all „casts“
- Development of bee brood, Egg laying rate, queen fecundity
- ability for complex interactions in the hive and colony,e.g. thermoregulation, communication in the hive to maintain colony wellbeing, brood care, etc….
- Communication of forage (waggle dance), orientation
- Capability to resist stressors e.g. diseases

- ➢ No specific tests for a number of important aspects available!
- ➢ Need for updating risk assessment schemes and methodology used!
- ➢ Need for higher tier testing with bee colonies for substances of concern

Risk assessors needs

- **Reliable** and **suitable** methods for assessment of effects
- **Reproducible** results
- **Meaningful** tests
- **Useful** endpoints
- A suitable risk assessment scheme to incorporate the tests
- A suitable risk assessment scheme to distinguish substances of low concern from those of potential concern
- Flexibility to adress additional concerns
- Feedback from practical use in realistic conditions (Monitoring, Incident monitoring)

pesticide exposure: routes, levels, effects?

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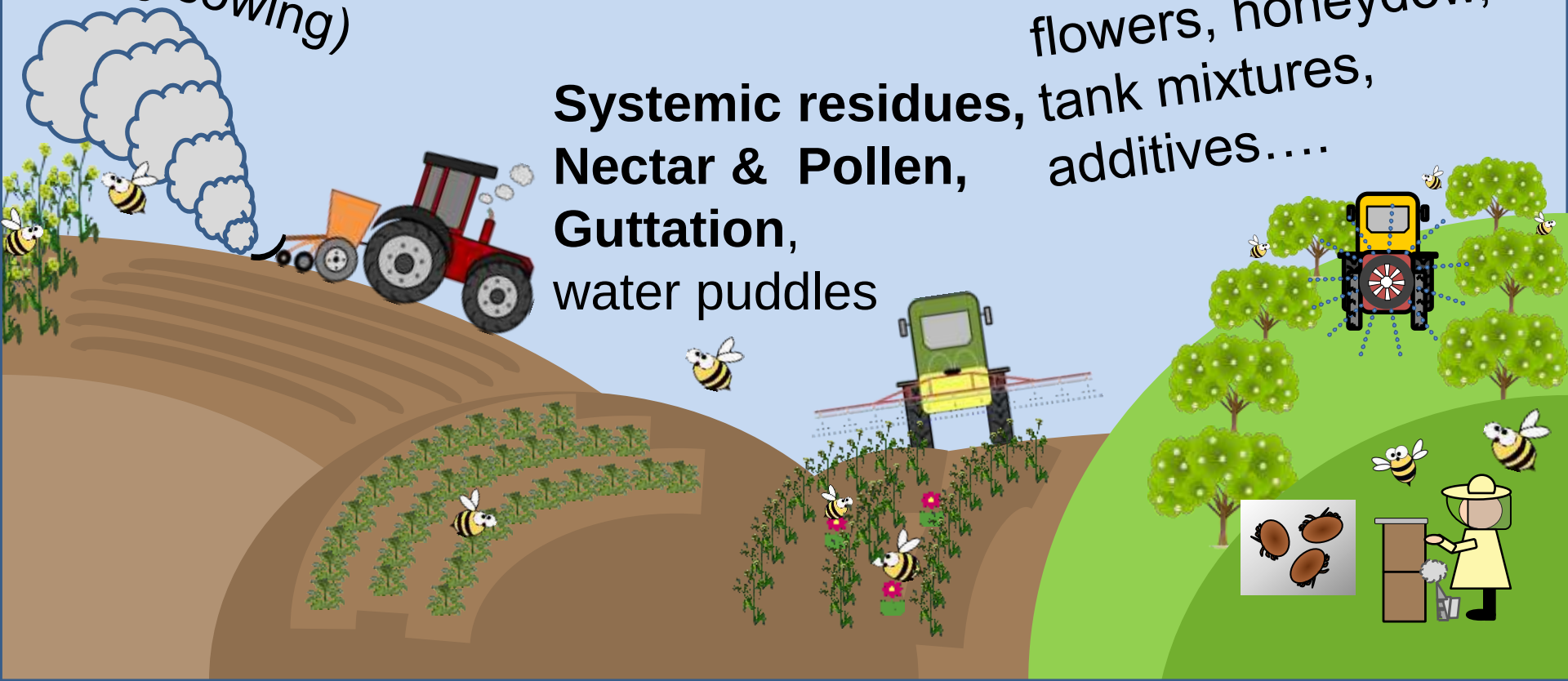
Seed treatments

Spray applications

Spray drift
dust drift
(during sowing)

Systemic residues, Nectar & Pollen, Guttation, water puddles

Spray applications:
Overspray, bees, flowers, honeydew, tank mixtures, additives….



Exposure during plant growth cycle

Insecticidal seed abrasion dust drift druing sowing → contamination of wild flowers, neighboring flowers

Guttation

spray during flower- during, before, after daily bee flight?

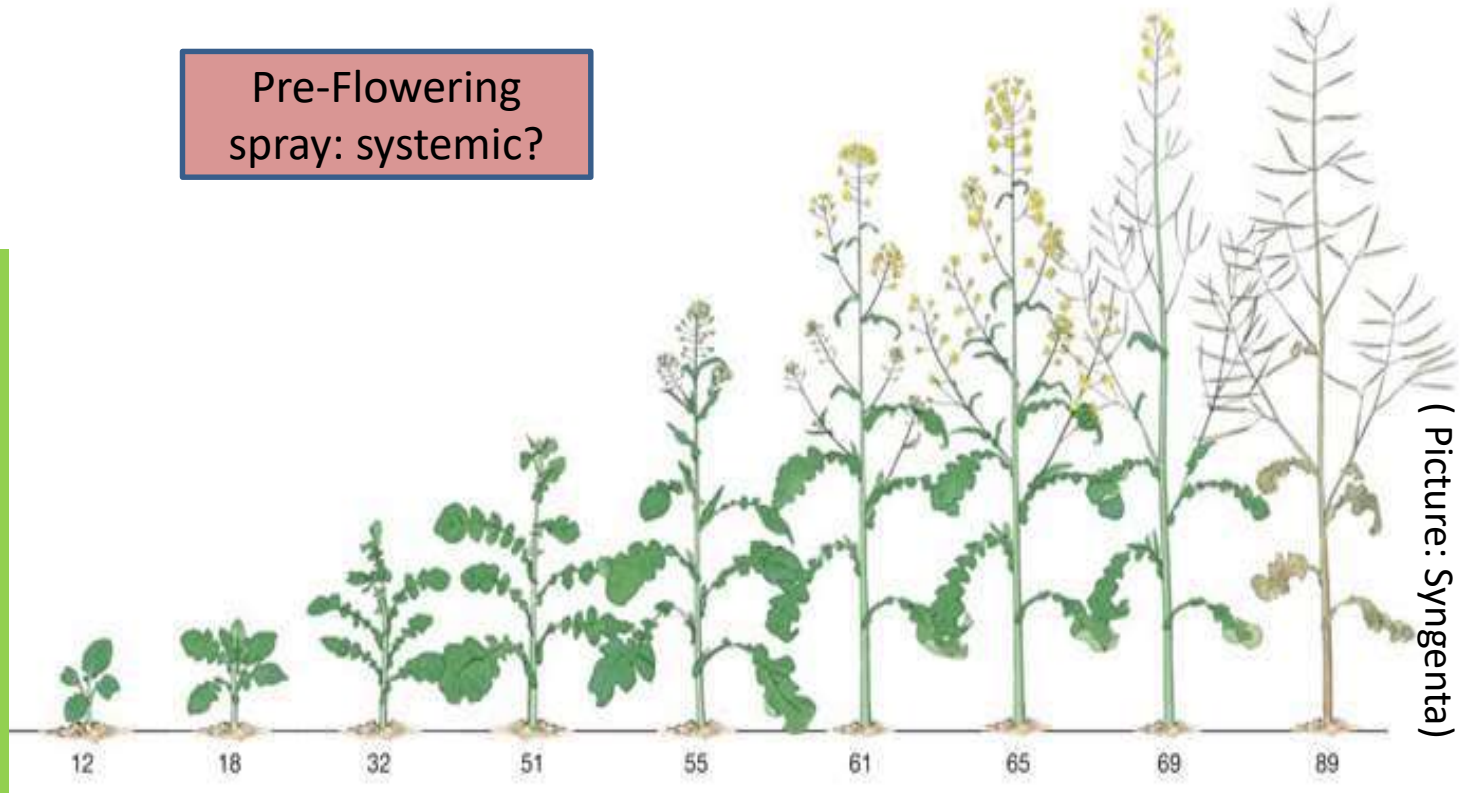
Systemic translocated residues from seed treatment

Flowering weeds?

Pre-Flowering spray: systemic?

OSR:
Sown in August
Overwinters
Flowers ~ April

Highly bee attractive- Nectar & Pollen



(Picture: Syngenta)

Exposure profile

- Crop dependend- every crop has a specific profile
- Crop attractivity – Nectar (Flower/extrafloral nectaries) and/or Pollen
- Plant protection Product (PPP) and active substance-properties, systemicity, persistence, mode of action
- Application type:
  - Spray – before, during or after flower
  - Seed treatment - time from seed to flower, crop type
  - Trunk/Stem injection
- Mode of application:
  - Type of sprayer, upward/downward application,
  - Nozzles and drift reduction
  - Sowing machinery, deflectors

→ Residue levels in bee relevant matrices

Validated Guidelines/Guidance

Honey bees	
Acute oral	***OECD 213 TG***
Acute contact	***OECD 214 TG***
Chronic 10-d adult	***New TG 245***
Larval acute	***New TG 237***
Larval repeated (=chronic)	***New GD 239***
Accumulative Toxicity	Calculation
Semi-field and field	***GD 75 (brood) EPPO 170***
Other, more specific aspects such as homing, HPG, …	***In progress, use of endpoints unclear***

Status
Available
In development/ready in near future/ already feasible
First studies have been performed. **Methodology not yet harmonized**. Data can be produced.

Validated Guidelines/Guidance

Bumble bees	Status
Acute oral- ***finalization***	**Available**
Acute contact- ***finalization***	**In development/ready** in near future/ already feasible
Semi-field and field ***- Ring-testing on-going*** 	First studies have been performed. **Methodology not yet harmonized**. Data can be produced.

Solitary bees
Acute oral- ***ICPPR ring-testing, TG /GD proposal in progress***
Acute contact- ***ICPPR ring-testing, TG /GD proposal completed***
Semi-field and field ***- Ring-testing ongoing*** 

More testing methods and study designs: suitable, applicable, appropriate for risk assessment?

- Many study designs available in open literature
- *e.g.*, Compendium: COLOSS Bee Book
- Includes toxicological testing
- Lab, Semi-field, field
- Mainly focus on honey bees, but some tests can be adapted for other bee species

Risk assessment: Dose – Response: risk, hazard, risk mitigation

Plant Protection Product:

- Active Substance
  (**Toxicity**, Mode of Action, Properties)
- Content of A.S.
- Formulation (Additives etc.)
- Crop
- Application, Timing
- **Amount of A.S. or Product per ha?**

Toxicity LD_{50} (in µg/Bee):

<1 µg / Bee = highly toxic
1 – 10 µg / Bee = toxic

10 – 100 µg / Bee = moderately toxic

– > 100 µg / Bee = not toxic

Higher tier Risk Assessment

Bee classification

B1: No application on flowering crops
B2: Application after daily flight until 11 pm

B3: Intended use-> no unacceptable exposure

B4: Application during Beeflight ok

Exposure estimates, Trigger values and their use in risk assessment

- **Risk assessment Schemes:**
  - Europe: EPPO 170 (4), EFSA Bee GD (+Roadmap?)
  - US-EPA, PMAR, CalDPR- „US Guidance“, …

1) HQ/EPPO- validated with field incidents, conservative <u>estimate</u>:

EUROPE (EU) and EPPO (European and Mediterranean Plant Protection Organisation) use **Hazard Quotient (Trigger 50)**

2) Newer schemes: Conservative calculation of toxicity/exposure

- *US-EPA, CAN-PMRA, CalDPR* use **Risk Quotient (LOC = 0.4)**
- *EFSA* **uses ETR-values (many different triggers)**

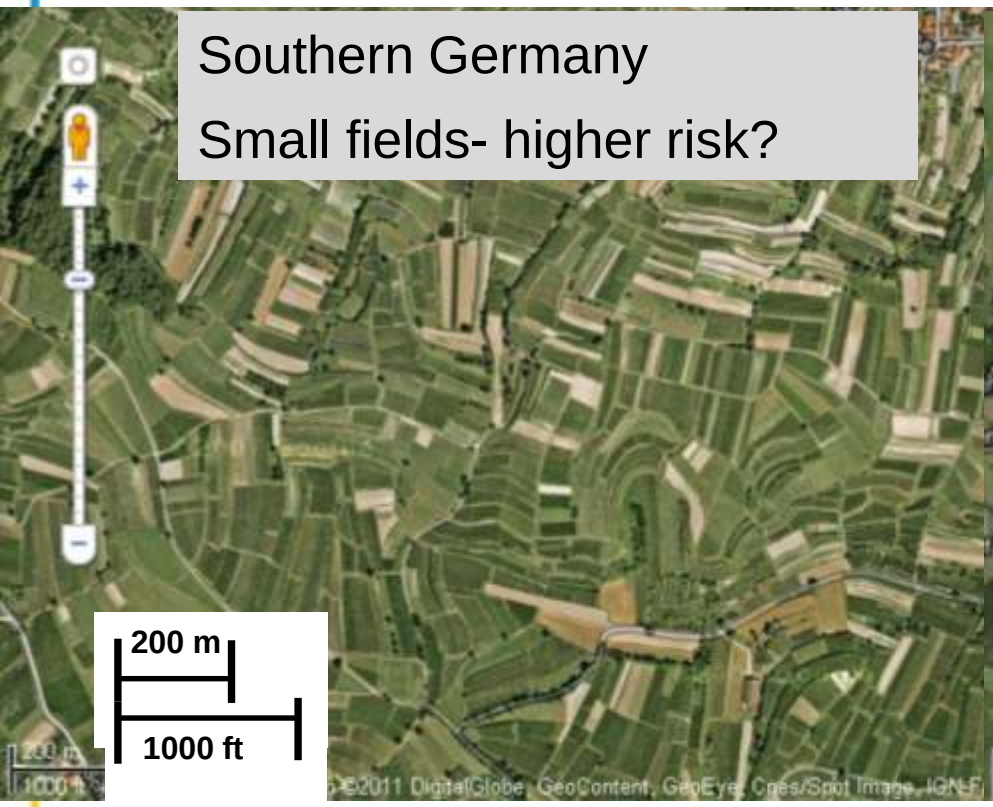
Higher tier studies

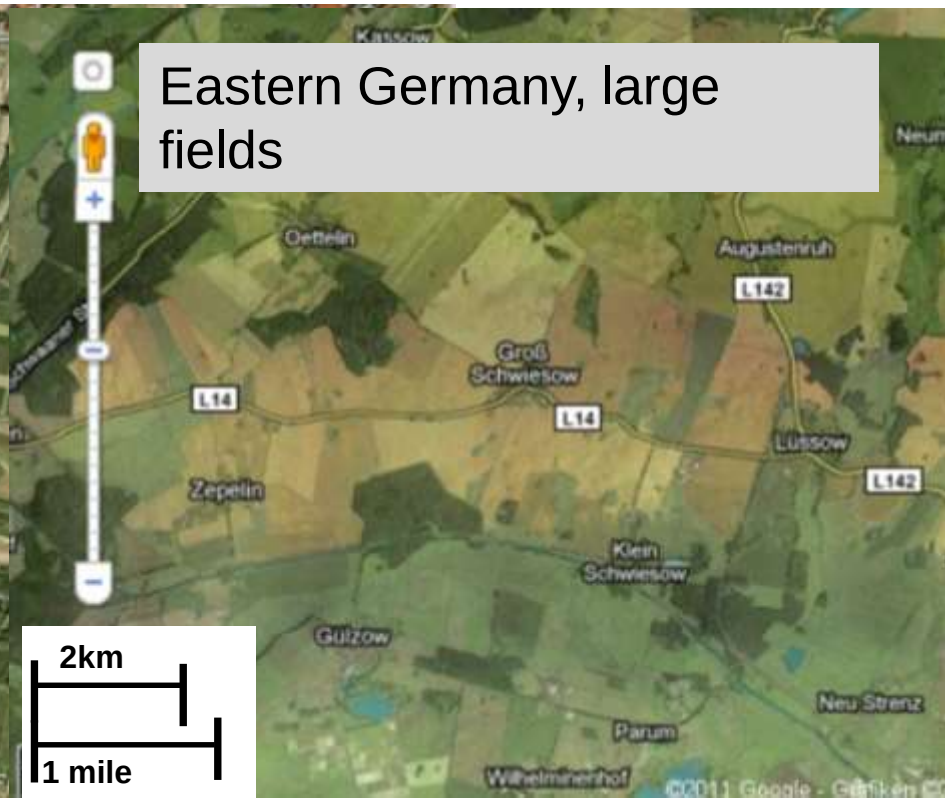
- Bee colonies
- Assessment of behaviour (flight entrance/foraging/colonies)
- Assessment of larval & brood development
- Assessment of colony strength (adult bees and bee brood) over at least 1-2 brood cycles after exposure
- Assessment of mortality

- In specific cases eg insecticides specific assessments, such as homing behaviour…

Risk may also depend on the landscape

Small fields- structures with many field edges, heterogenic agricultural structur- WOSR surrounded by many maize fields… Scenarios that need to be covered by Risk Assessment





Source: google maps

Critical remarks and questions: test methodology, risk assessment & management, conservatism vs. realism?

- Many methods are available; some need further investigation. It´s not about the battery of available tests, but the use of measurement endpoints and their linkage to assessment endpoints, protection goals on colony/population levels
- many scientific core issues are not yet sufficiently investigated, but guidance has been developed!
- There is a high attention for „new methods“, as if all the problems were to be solved only within Risk Assessment
- Tiered approach –evaluating hazards or risks? Do we achieve necessary the balance between conservatism and realism? Assess „acceptable“ risks in realistic conditions? There are „sound“ and „unsound“ conclusions around…
- Not all issues regarding pollinator protection can be regulated with pesticide regulation- more holistic approaches are needed!

Exposure during plant growth cycle

Insecticidal seed abrasion dust drift druing sowing → contamination of wild flowers, neighboring flowers

Guttation

spray during flower- during, before, after daily bee flight?

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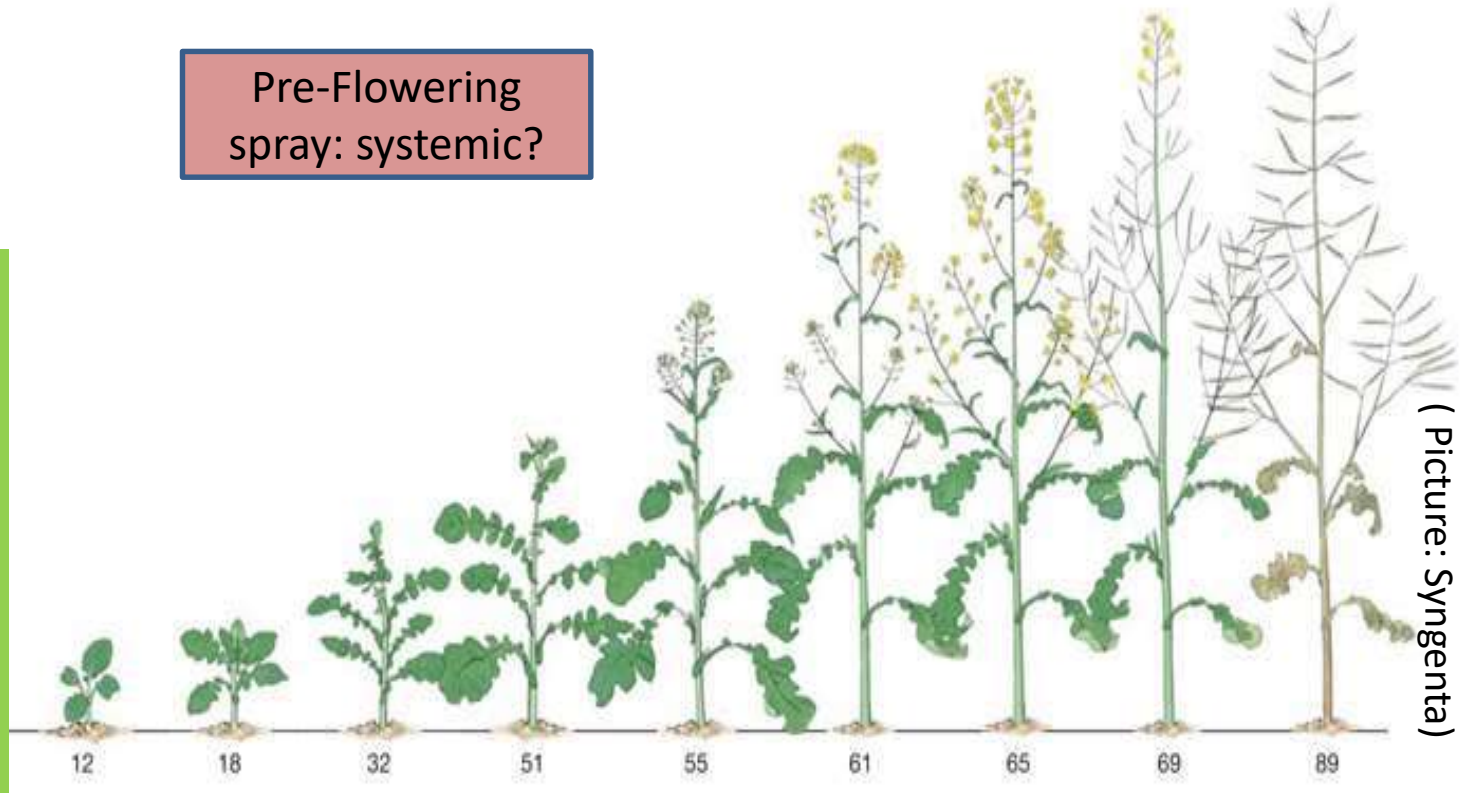
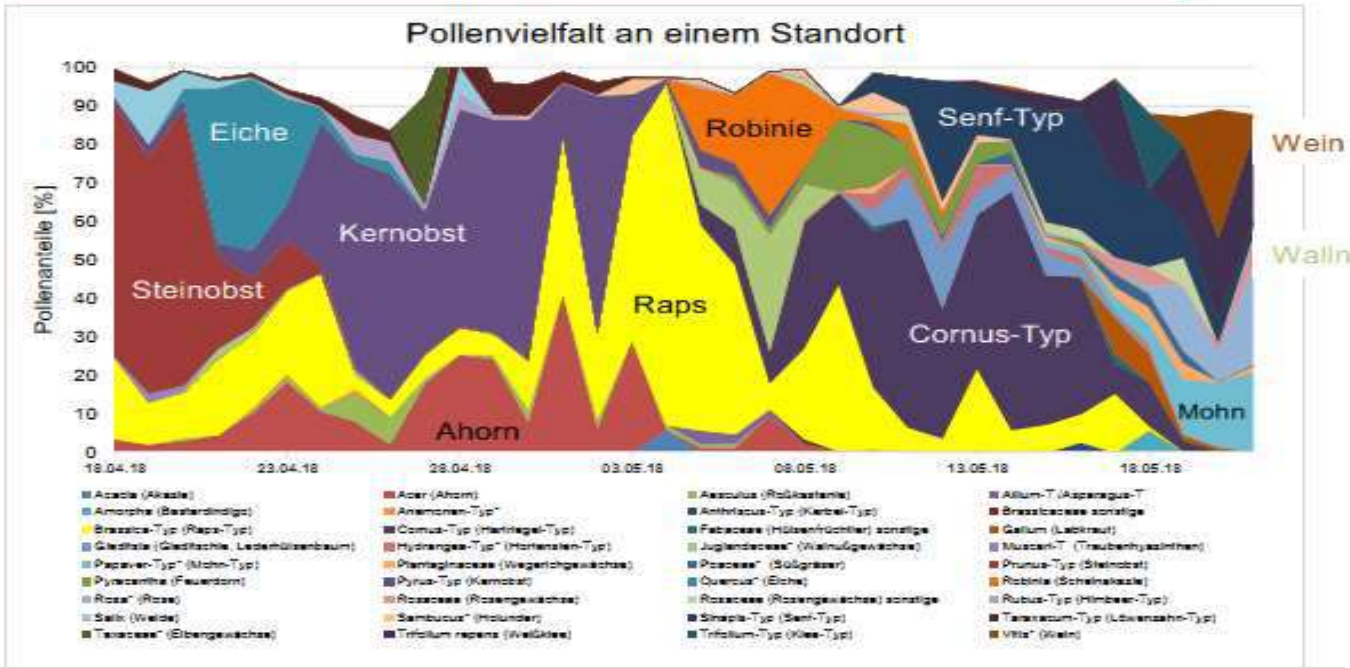


(Picture: Syngenta)

Exposure levels vary

- Sprays: usually highest concentrations Day of application, soon decreasing values
- Dust drift: very high residues on day of application **if there is dust drift**
- Guttation: very high values over a relatively long time

- **Contaminated matrices:**
- Most important: nectar and pollen!
- Pollen usually shows a higher contamination than nectar, often factor 10



Slide: C. Otten, FBI (Fachzentrum Bienen und Imkerei)

Risk assessment is conducted with worst-case or realistic exposure- in real life there should be factors that decrease the risks further (other forage) but also such that create further uncertainty (other treatments with other products, potential mixture toxicity)

Exposure and risk under realistic conditions- Guttation

Occurence of Guttation **depends on** e.g. plant type, environmental conditions,…

Exposure depends on Occurence of Guttation and

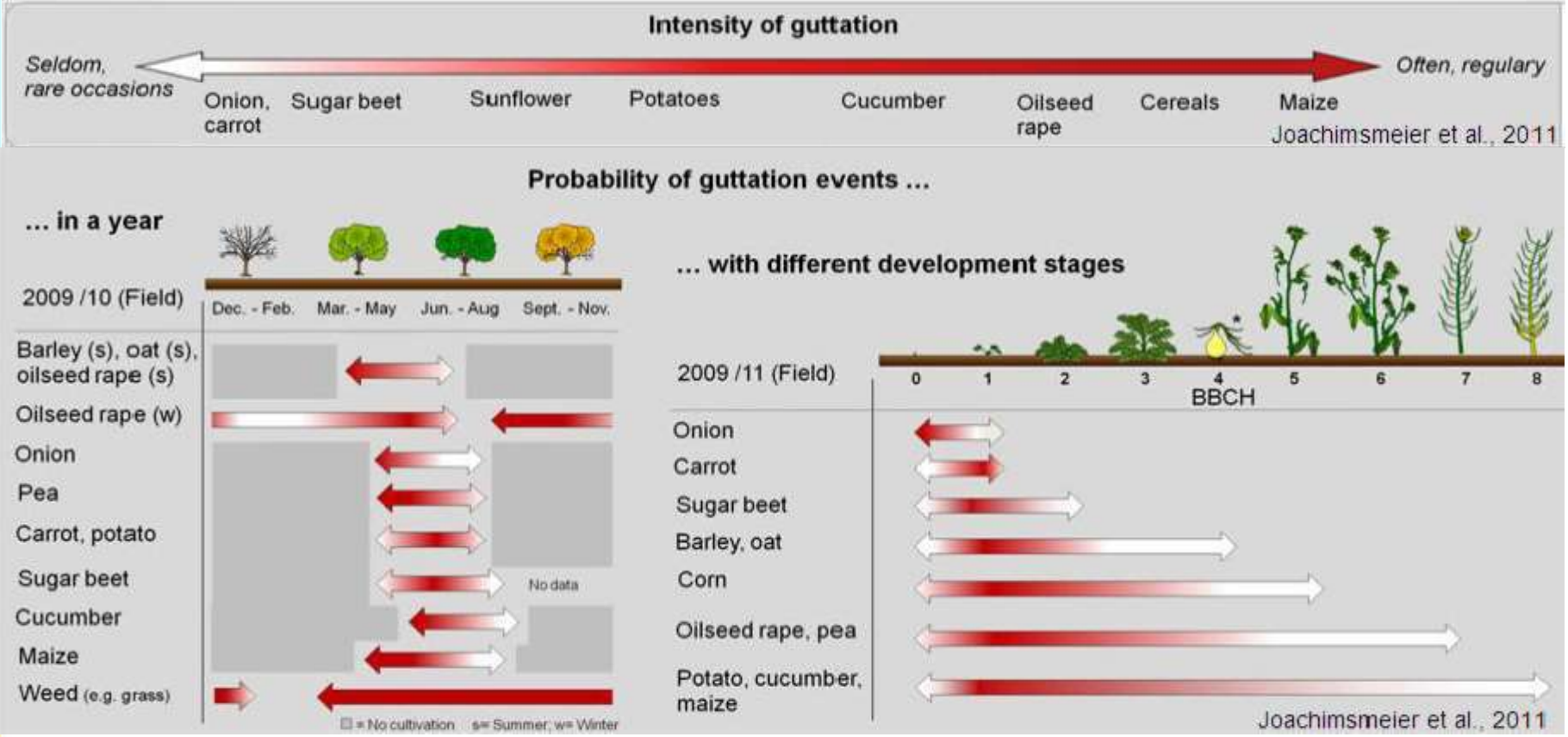
- active substance, seed loading
- distance of bee colonies to treated crop

Risk for bees depends on exposure and

- amount of alternative, uncontaminated water sources in flight range
- Use of guttation droplets from treated plants
- Weather conditions

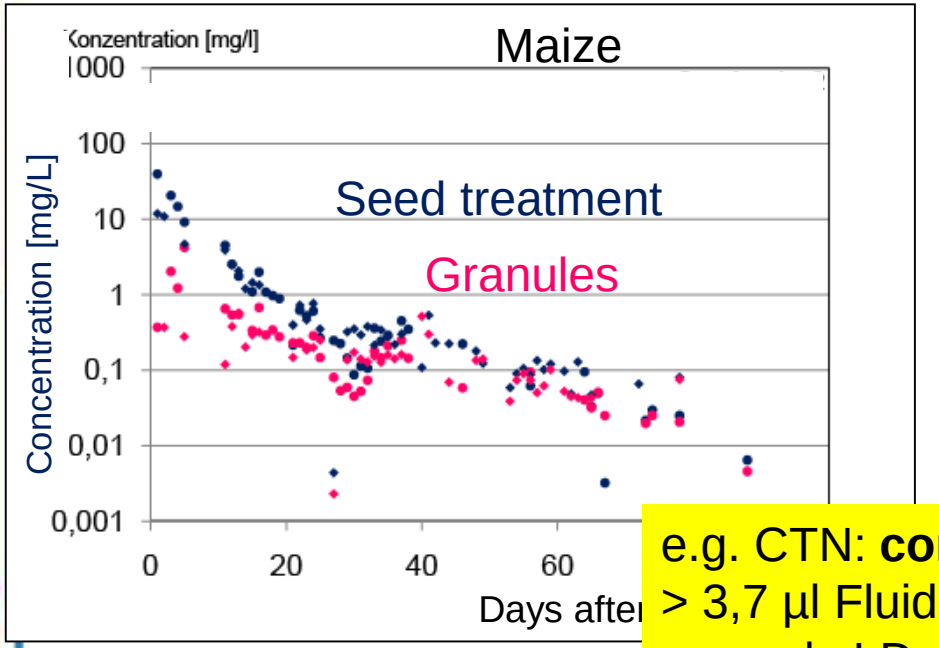
Occurrence of Guttation:

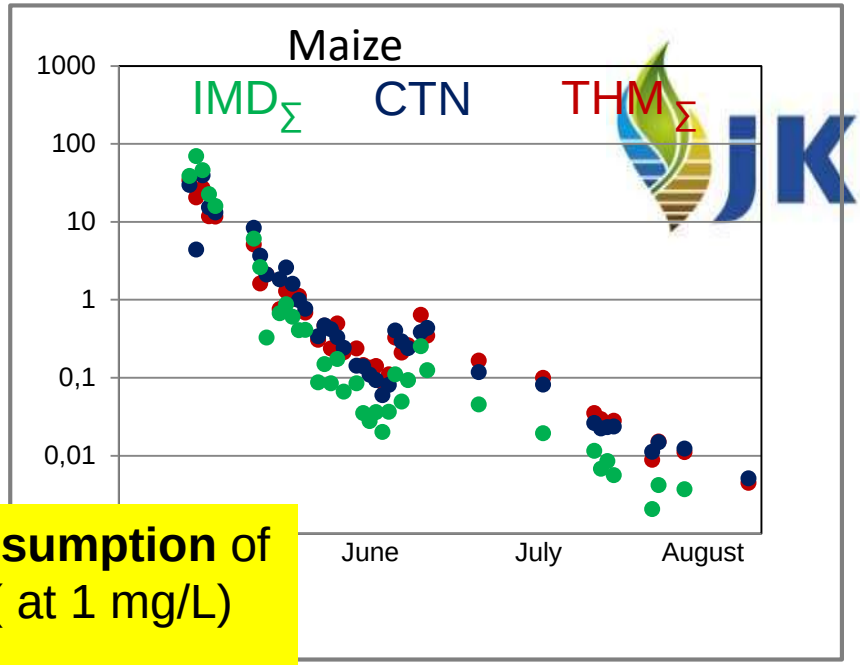
Who (which plants). **When** (time of day, month, year). **How much** (different



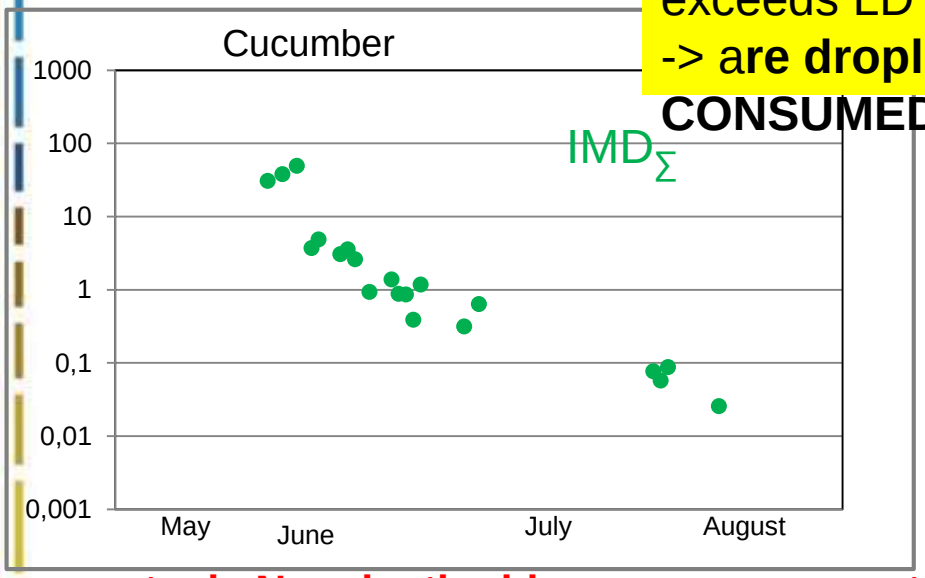
Data available for wheat, maize, barley, oilseed rape, oat, carrot, cucumber, aubergine, capsicum, onion, pea, potato, sugar beet, tomato

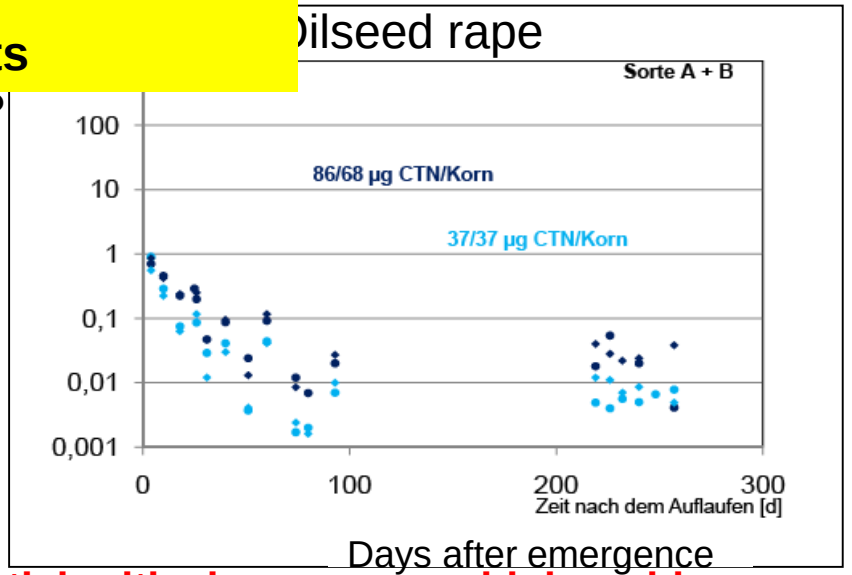
> Occurence, frequency, intensity varies between crops





e.g. CTN: **consumption** of > 3,7 µl Fluid (at 1 mg/L) exceeds LD_{50}
-> a**re droplets CONSUMED?**





e.g. toxic Neonicotinoids: many crops- potential critical <u>exposure</u> – high residue loads- but do bees and colonies actually use it? Which <u>risk</u> in real life?

Honey bees need water. Is guttation a relevant water source for honey bees?

Water use of honey bees
Regulation of air humidity and temperature (cooling) in the hive
Need for minerals
Dilution of honey from 20 % water to 80 % before feeding, larval food: high water content
Water for own use

Water sources
in surrounding: Rivers, Puddles, ponds…..
Dew
Condensed water in hive
Nectar with high water content
water supply for colonies
Guttation untreated plants
Guttation treated plants

Monitoring- example neonicotinoids- oilseed rape, residues in nectar and pollen

- Seed treated winter oilseed rape allmost all fields in DE ~15 years
- Incident investigation: no incidents reported due to exposure to dust drift, guttation, necar and pollen with neonicotinoids
- DEBIMO: Data show frequently high numbers of pesticides from spray applications in bee bread- neonicotinoids very rare findings only
- Data show, that also the colonies which were exposed to N/P of WOSR can be overwintered successfully
- WOSR attractive crop for beekeepers- large numbers of colonies are migrated every year for honey production and colony development boost

Monitoring- example neonicotinoids- spray applications in potatoes

- Spray applications with neonicotinoids frequently- problems have arisen due to honey dew production or weeds in the field
- If risk mitigation measures are not followed, severe poisoning incidents have occurred
- Several poisonings in potato every year
- Several reports of misuse/abuse every year

- Incidents in potato 2003 and 2006- risk mitigation measures were checked and significantly improved- in the following years the incidents have significantly decreased

Factors to be considered for risk evaluation of dust drift during sowing

(similar aspects valid for granular dust!)

- **Emission of a.s. is influenced by:**
  Seeding rate/ha x abrasion rate x % active substance in dust (+ dust particle size distribution, driller type, drilling width, soil humidity, wind speed / direction)
- **Exposure influenced by:**
  Emission + distance to emission, wind conditions, stickiness of plant surface and adjacent plants structure
- **Effects influenced by:**
  Exposure + sensitivity and biology of organisms (e.g. presence, place, type and intensity of activity)

Risk assessment: tiered Approach

Standnardisatio

1st Tier / Labor

Trigger-Values indicate further higher tier studies necessary

2nd Tier / Semi-field

3rd Tier / field

Landscape level Monitoring

Ecological relevance, complexity

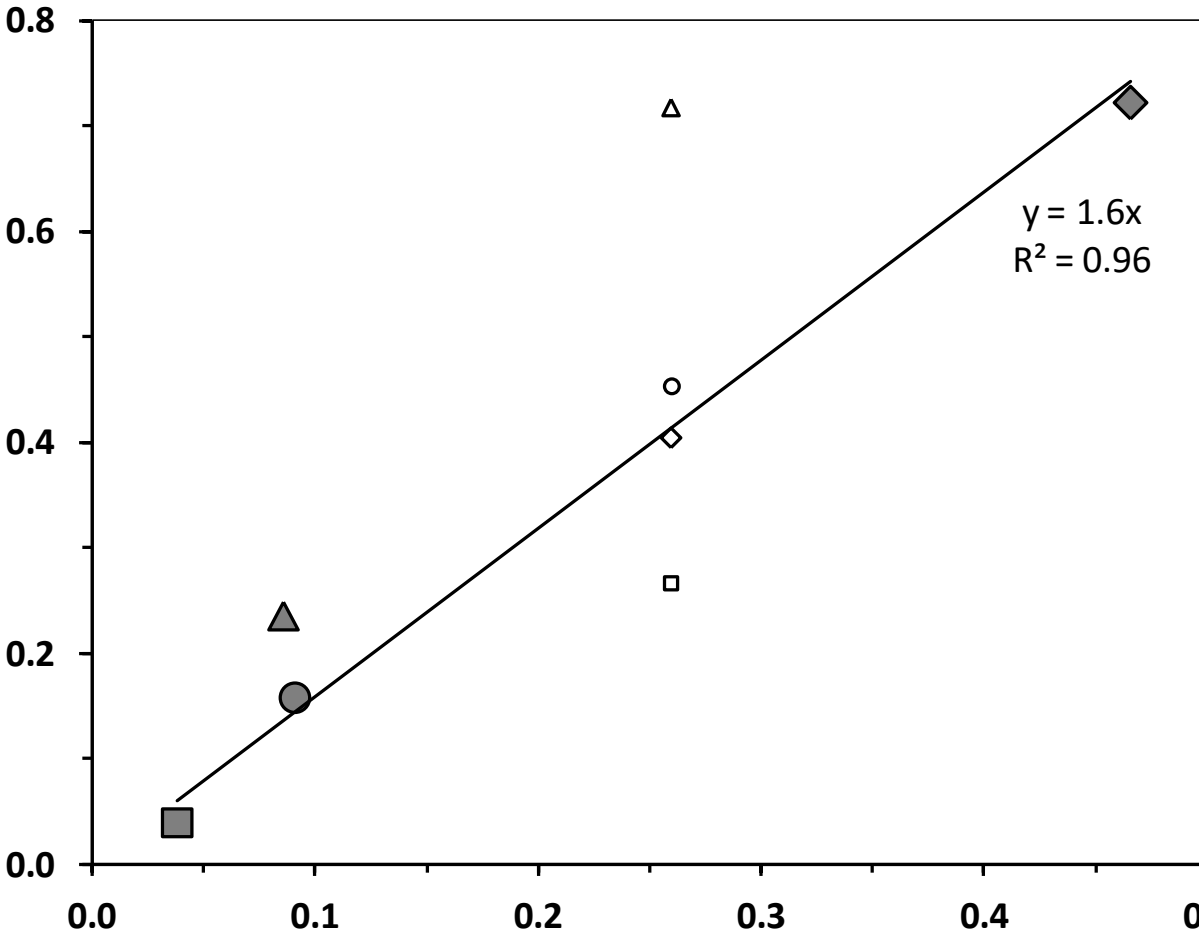
Methodology: How to test effects of dust exposure?

- **Laboratory**:
  - solid state & varying particle size make it challenging to develop standard ways of applying dust acute oral/contact tests.
  - Toxicity driven by a.s. but different state – particles- are likely to have a different potential to cause effects
- **Semi-field:**
  - application of target amounts possible
- **Field**:
  - realistic sowing very labor-intensive (and a lot of luck needed).
  - New machinery to apply target amounts in the field (but what amounts need to be actually be applied?)

Factors which seem possible for a risk reduction

- **Sowing rate (more seeds = more dust emission)**
- **Soil and wind conditions during sowing**
- **Distance of sowing to adjacent off crop habitat**
- **Sowing equipment (e.g. deflectors, construction of drillers, use of filters / cyclones)**
- **Dust abrasion from seeds (e.g. pre-cleaning of seeds, use of stickers, conditioners)**
- **Amount of a.s. in dust (treatment recipes, sequential appl., uncontaminated outer layer)**
- **Handling and storage of seeds**

Seed treatment Quality and Exposure



How to test effects following dust drift and dust exposure ?

- **Laboratory**: solid state & varying particle size make it challenging to develop standard ways of applying dust acute oral/contact tests.

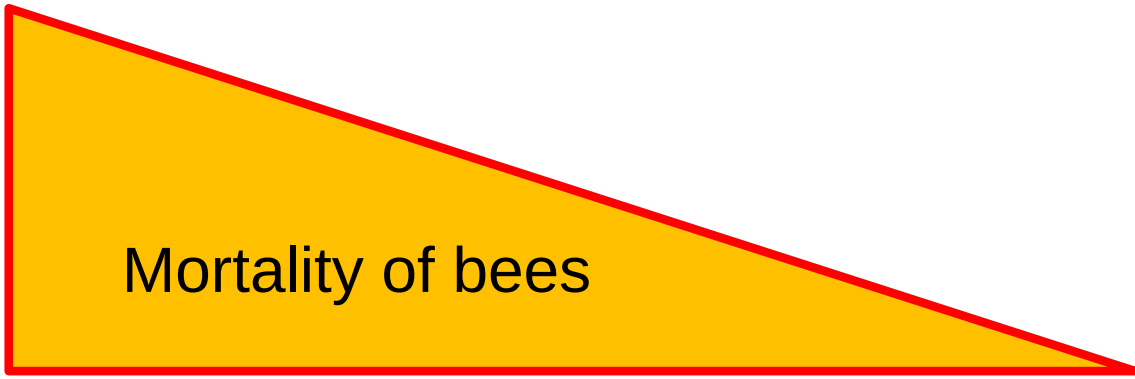
  Dusts are of similar toxicity compared to sprays (e.g. Sgolastra et al. 2012 and Registrant´s data)
- **Semi-field:**
  a. **methods for** manual application of target amounts (e.g. Sgolastra et al. 2012, Georgiadis et al., 2012)
  b. **Realistic exposure - sowing of dusts. With one limitation: no exposure to "dust cloud in the air"**
- **Field**:
  a. **Realistic sowing**. Very labor-intensive (and a lot of luck needed). (different approaches available, e.g. Apenet, JKI)
  b. Machine assisted **application of target amounts** (Pistorius et al., 2016)

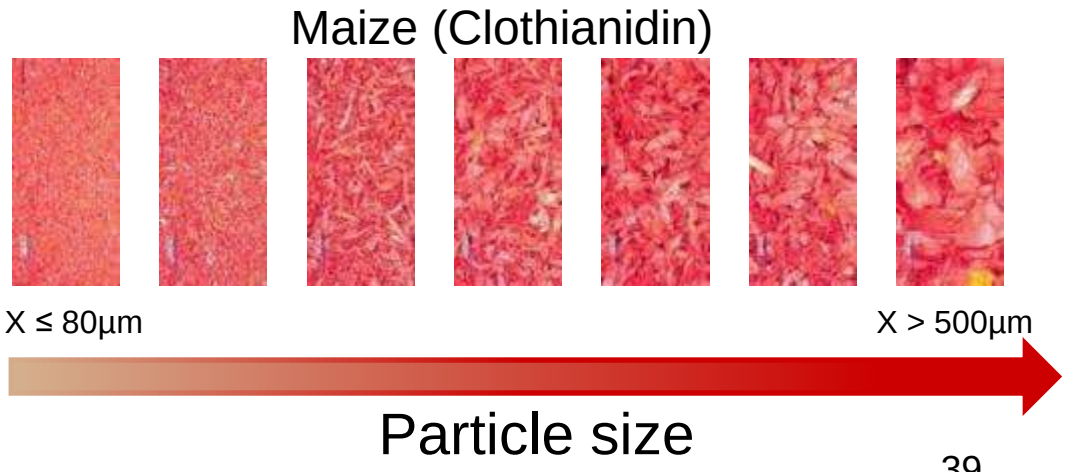
Smaller fractions of dust fly longer distances and cause greater effects


Fractioning of dusts

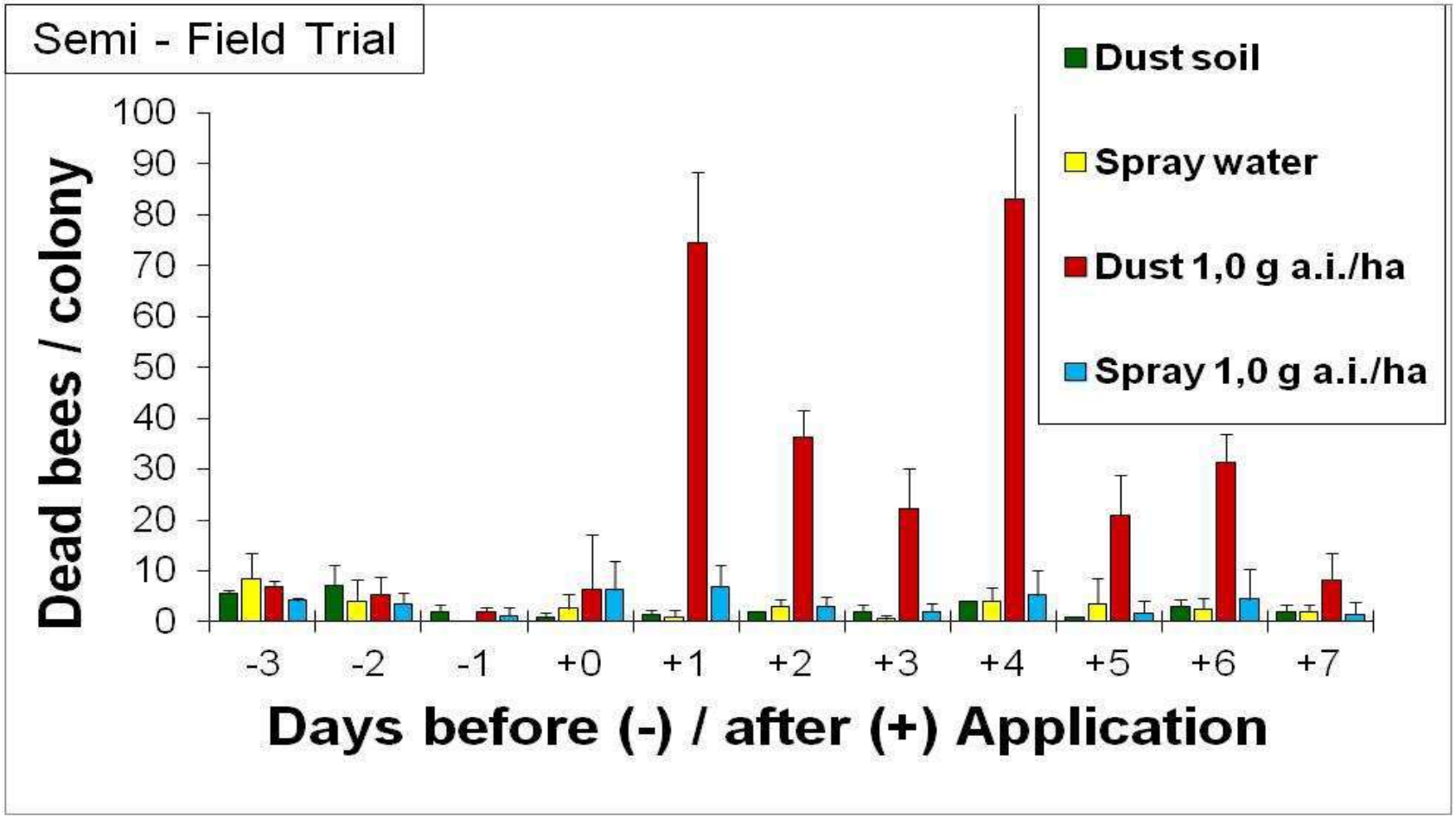
Particle size in µm	% clothianidin
< 80	16.2
80 – 160	17.7
160 – 250	16.9
250 – 355	14.6
355 – 450	13.5
450 – 500	13.4
> 500	12.4

Hand operated application of different dust fractions - results of semi field trials:



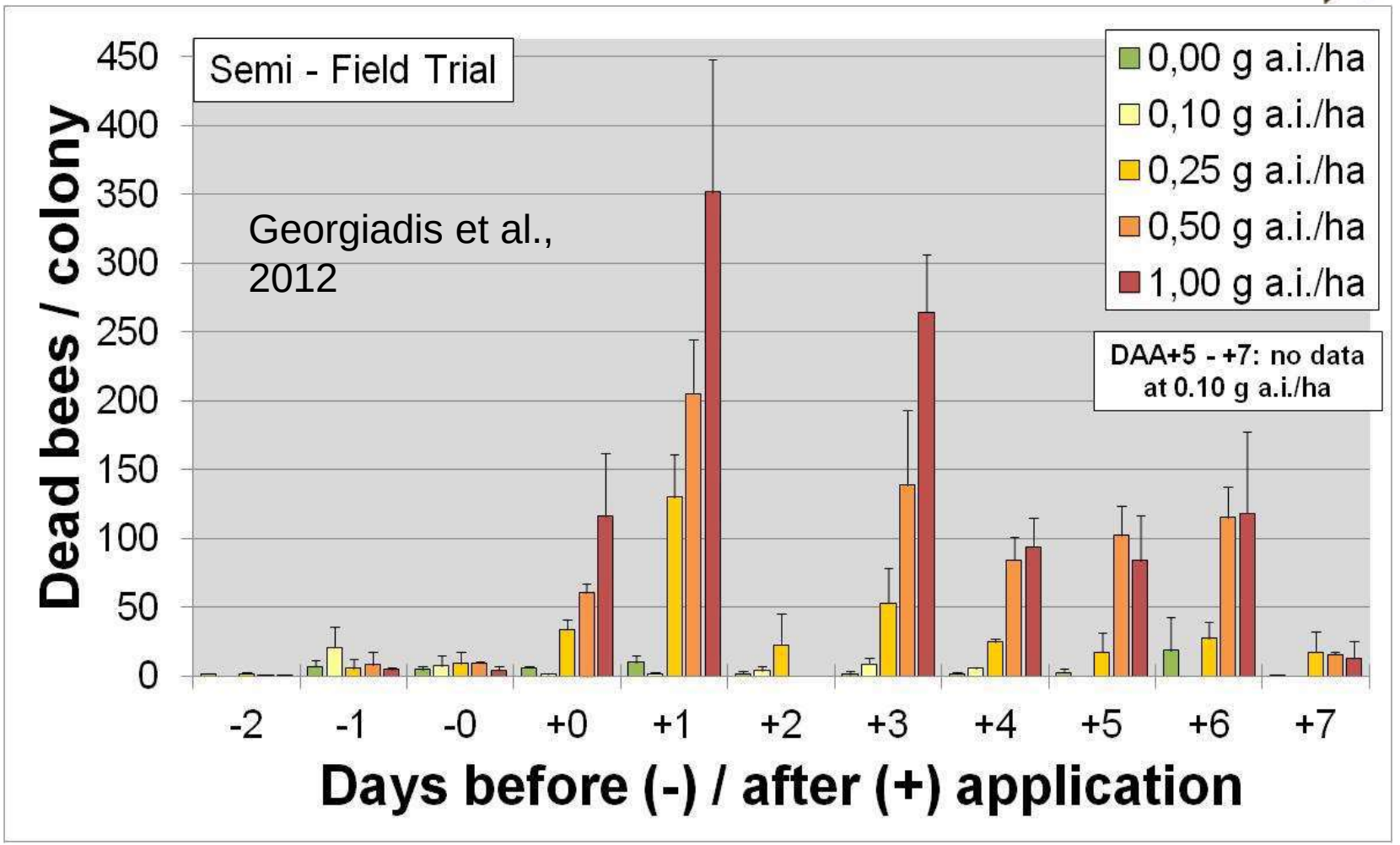


Semi-field (n=3), manual dust (≤ 160 µm) application vs. Spray application each with 1 g clothianidin /ha



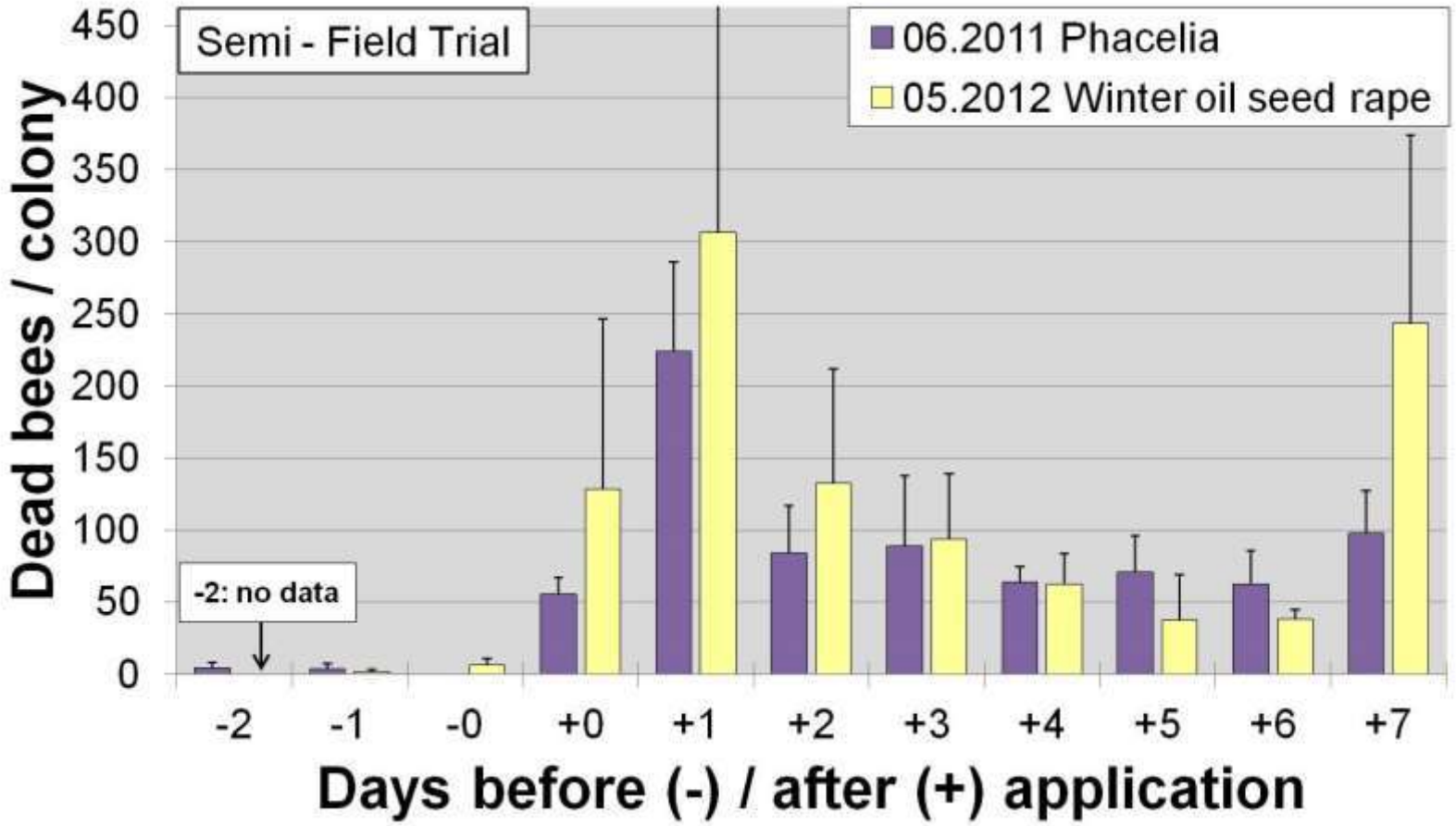
→ Dust particles pose <u>higher risks</u> compared to sprays!!!
(solid particles remain on plant and flower surfaces)

Semi-field (n=3), manual dust (≤ 160 µm) application, different application rates of clothianidin/ha



→ Dose-response. NOER ~ 0.1 g as Clothianidin / ha, LOER 0.25 g as/ha? 0.05 g as/ha (Sgolastra et al.,

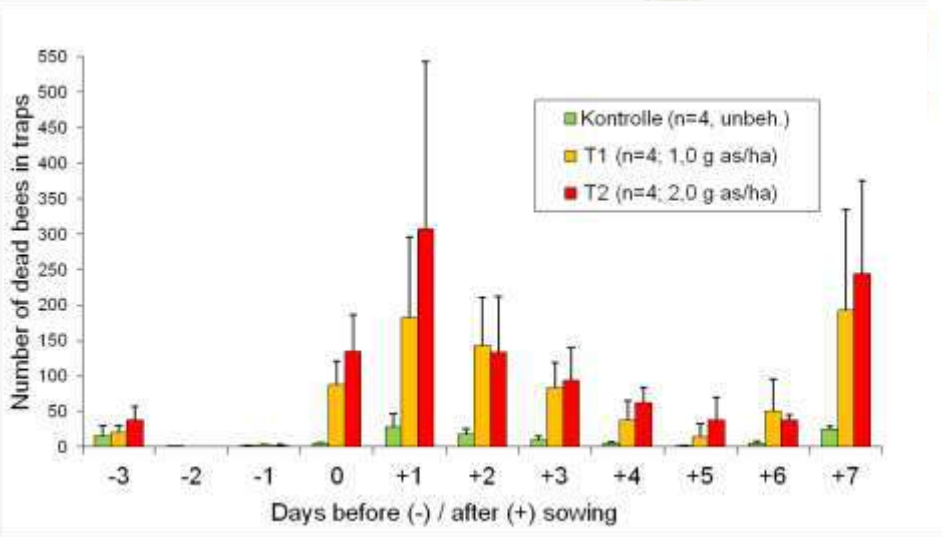
Manual application of 2.0 g a.i./ha, particle size: x ≤ 160 µm on different types of flowers: Phacelia and WOSR



Similar effects after application on Phacelia and Winter oilseed rape- Data can be extrapolated. Allows flexibility for future testing.

Manual application of dusts

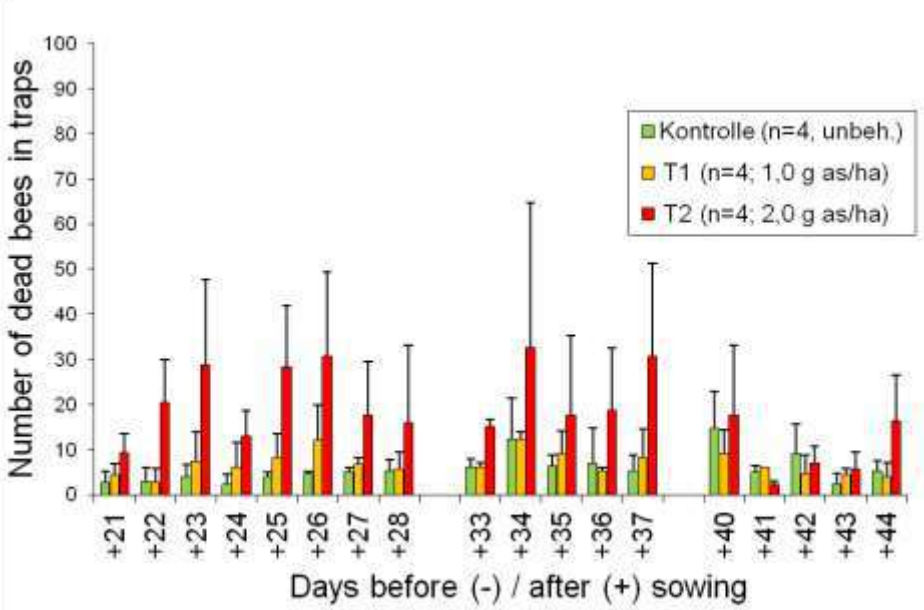
„acute Mortality“ →



3-5 weeks later →

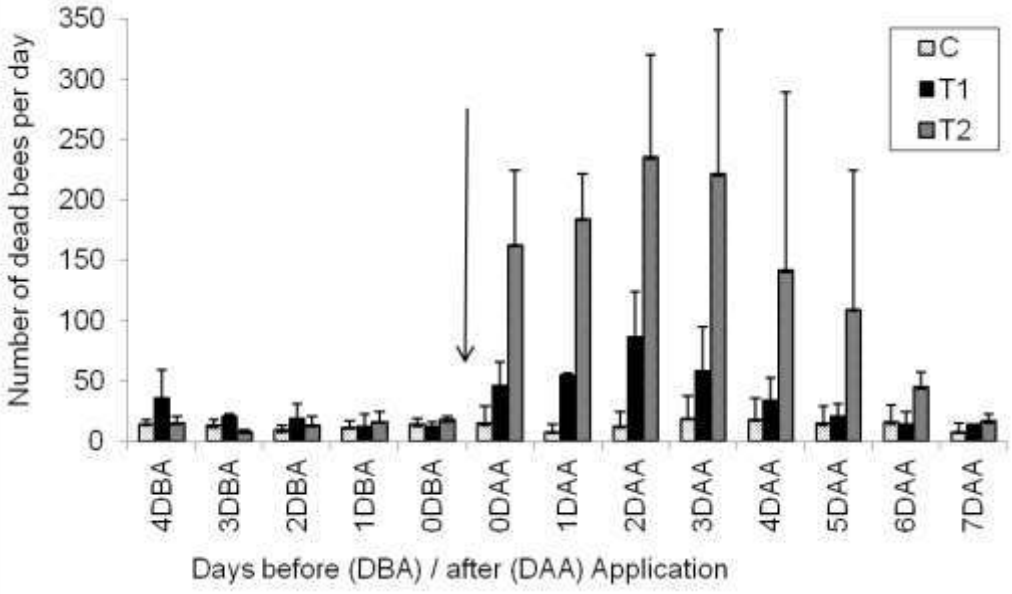
Mortality still increased after 3 weeks, due to

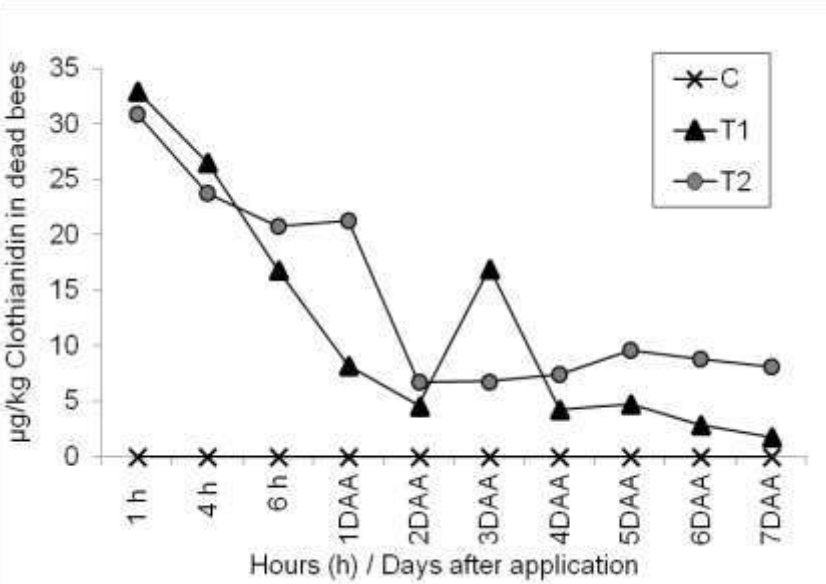
particles in bee bread, collected with pollen and body hairs



→ „Extended“ mortality several weeks after initial exposure.

Field application of dusts





→ Possibility to determine NOEC/LOEC values

Pistorius J., Wehner A., Kriszan M., Bargen H., Knäbe S., Klein O., Frommberger M., Stähler M., Heimbach U., 2015. Application of predefined doses of neonicotinoid containing dusts in field trials and acute effects on honey bees. *Bulletin of Insectology* 68 (2): 161-172.

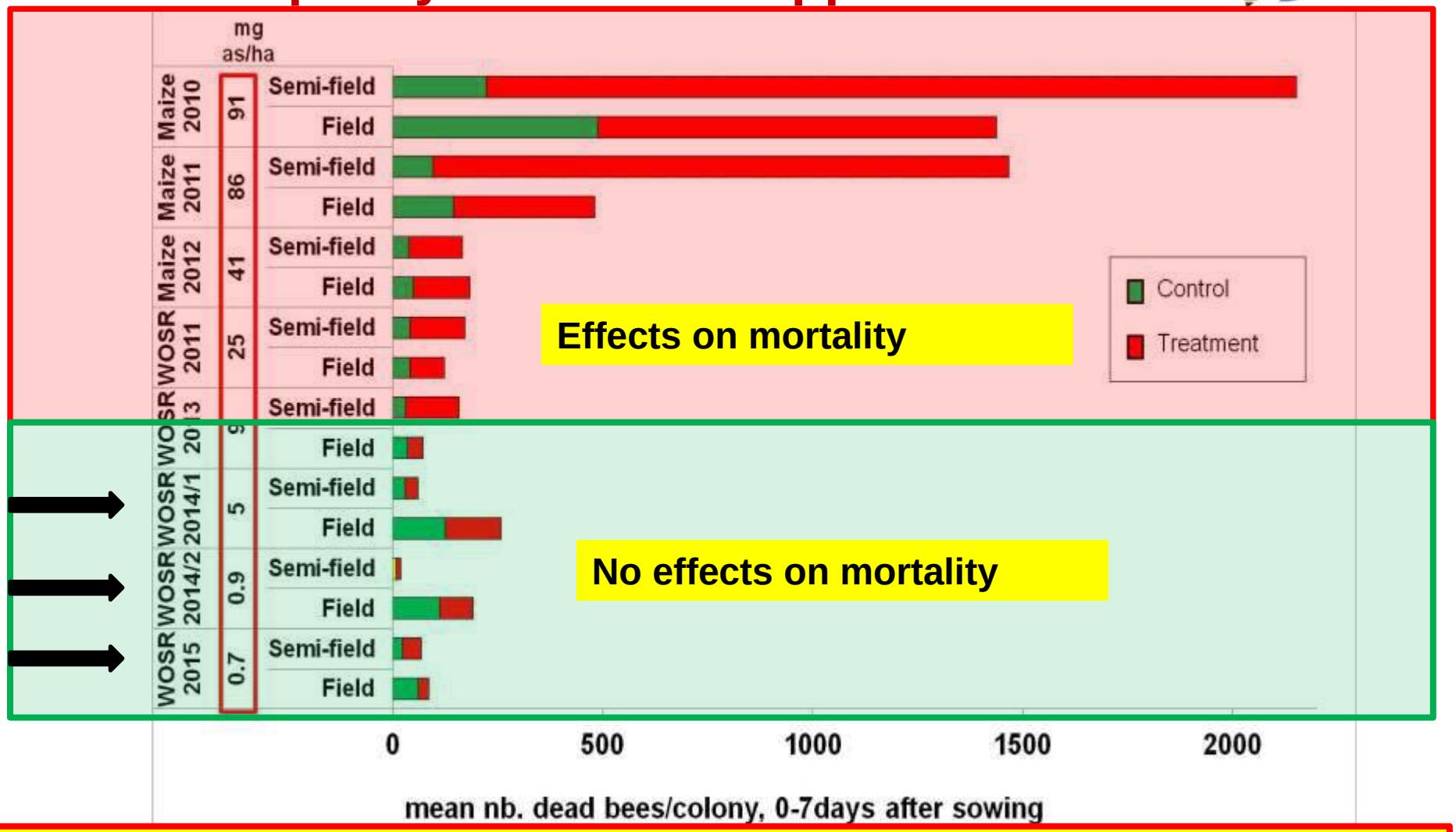
Small Semi-field colonies ~5000 bees

Petridishes + 3 D Gauze nets

Flower samples neighbouring crop

Field exposure, full size colonies ~25000 bees

Insecticidal dust drift: risk depends on abrasion quality but less on application rate!!!



Improving seed treatment quality & testing machinery: risk mitigation to achieve acceptable levels of environmental risk (for honeybees and other organisms)

Institute for Bee Protection

Tasks related to:

Plant Protection Products (PPP)

Julius Kühn-Institut
Bundesforschungsinstitut für Kulturpflanzen

I. Risk assessment of plant protection products/bees

II. Examination center for bee poisoning incidents

III. Research on risks of pesticides to bees





www.jki.bund.de

„ I have an incident“ – what is the cause?

Examination of bee incidents in Germany

- **Free of charge for beekeepers –** any beekeeper (from Germany) with a incident of unclear reason may send us samples for investigation
- **Official assistance in all federal states established**: (bee &) plant sampling by plant protection services or other authorities, bee keeping advisory services, bee institutes

- **Biological & chemical analyses**
  - Visual inspection
  - Phaenological determination of pollen loads and of pollen attached to hairs
  - Biotest with larvae of *Aedes aegypti*
  - Disease/parasite analyses: *Nosema spp., Varroa, Viruses*
  - Residues: GC/MS and LC MS/MS, ~ 280 a.s.

Possible reasons for bee damages

Time /Symptoms

- Winter losses of colonies
- Weakening during season
- Acute poisionings
  e.g. from pesticides

<u>Possible Causes (monocausal / multifactoriell)</u>

- Parasites, Diseases, Viruses
- Poisoning on purpose
- pesticides
- Bee keeper and beekeeper´s activities
- Farmer and agricultural activities
- Other factors? Mobile phones….?
- Other substances?

Possible Symptoms of bee poisoning

- Classical poisoning symptoms of bees: Trembling, shaking, cramping, vomiting, orientation disorder, aggressivity…
- Acute Mortality
- Loss of foragers
- Brood damages: z.B. dead brood, deformed brood e.g. Insegar-eyes,...
- Delayed development of individuals or of colony
- Amount of Bees and bee brood
- Abnormal behaviour at the hive entrance
- Poor success of queen breeding/ death of queens..

Poisoning of bees from pesticides

Factors influencing the occurrence and the extent of poisoning damage

Pesticide applied, (**Tracht (forage) and use of this forage)**

- Active substance (**Toxicity**, Mode of action, Substance properties)
- Amount of a.i. in the product
- Formulation (additives)
- **Product/Application rate per ha** – Risk for bees?



Entstehung von Bienenvergiftungen

Factors influencing the occurrence and the extent of poisoning damage

- Attractivity of treated crop(s) and attractivity of other untreated crops in the area
- Individual behaviour of colonies– single colonies of an apiary can be damaged by pesticides in cases of „small“ contaminated areas- when fields are treated usually most-all show symptoms
- Strength of colony
- climatic Conditions
- Distance apiary – Poisoned Crop
- Exposure: Attractivity , Extent and relevance of the exposure




JKI

- Investigation of the cause of the incident
- Aid for insurance regulation and court cases
- Communication with Plant protection services of federal states and other institutions involved in the incident
- Final conclusion on the cause of the incident, evaluation of the link with pesticide application
- Consideration of the information of risk assessment, feedback with risk assessment and risk management

What does an incident scheme tell us? How reliable is the information that we get?

Pros	Cons
Analyses free of charge for beekeepers	Sensitivity issue- honeybees may or may not cover all effects
Honey bee colonies forage orver large areas and will find bee attractive crops	Very small and local events may not be detected
If there are misuses or adverse effects from PPP use, beeekepers will be the first/only ones to notice due to honey bee´s ability to comunicate crops	„social“ aspect- not all incidents will be reported due to neighbourhood relations etc.
If there are adverse effects, at least some foragers will come home and die there	Honey bee incidients- do not give us clear information about the magnitude of effects
	Not all effects will be detected- no precise measure

Beecheck- new bee counters as a solution for monitoring or effect trials?

Not every incident is a pesticide poisoning!

High acute mortality from one day to the next, thereafter increased over weeks to months.

Single colonies affected at 2 apiaries.

Several residue analyses show traces of different actives but no clear picture.

ABPV	BQCV	CBPV	DWV	SBV
+	+++	-	-	++

Other example of incidents but no link with pesticides





Black Queen cell virus infection of worker brood

Methodology & examination of bee incidents
biological and chemical analyses
→ **poisoning or other causes e.g. diseases?**

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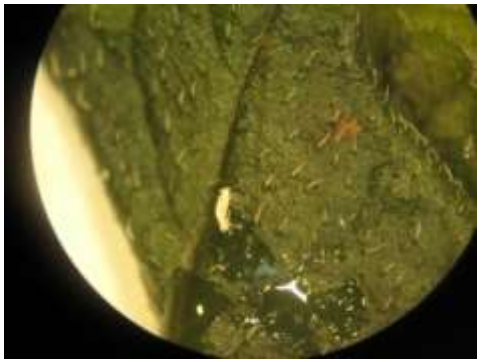
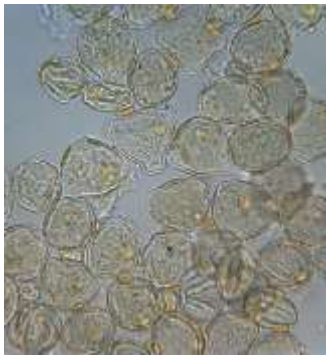
Federal Research Centre for Cultivated Plants



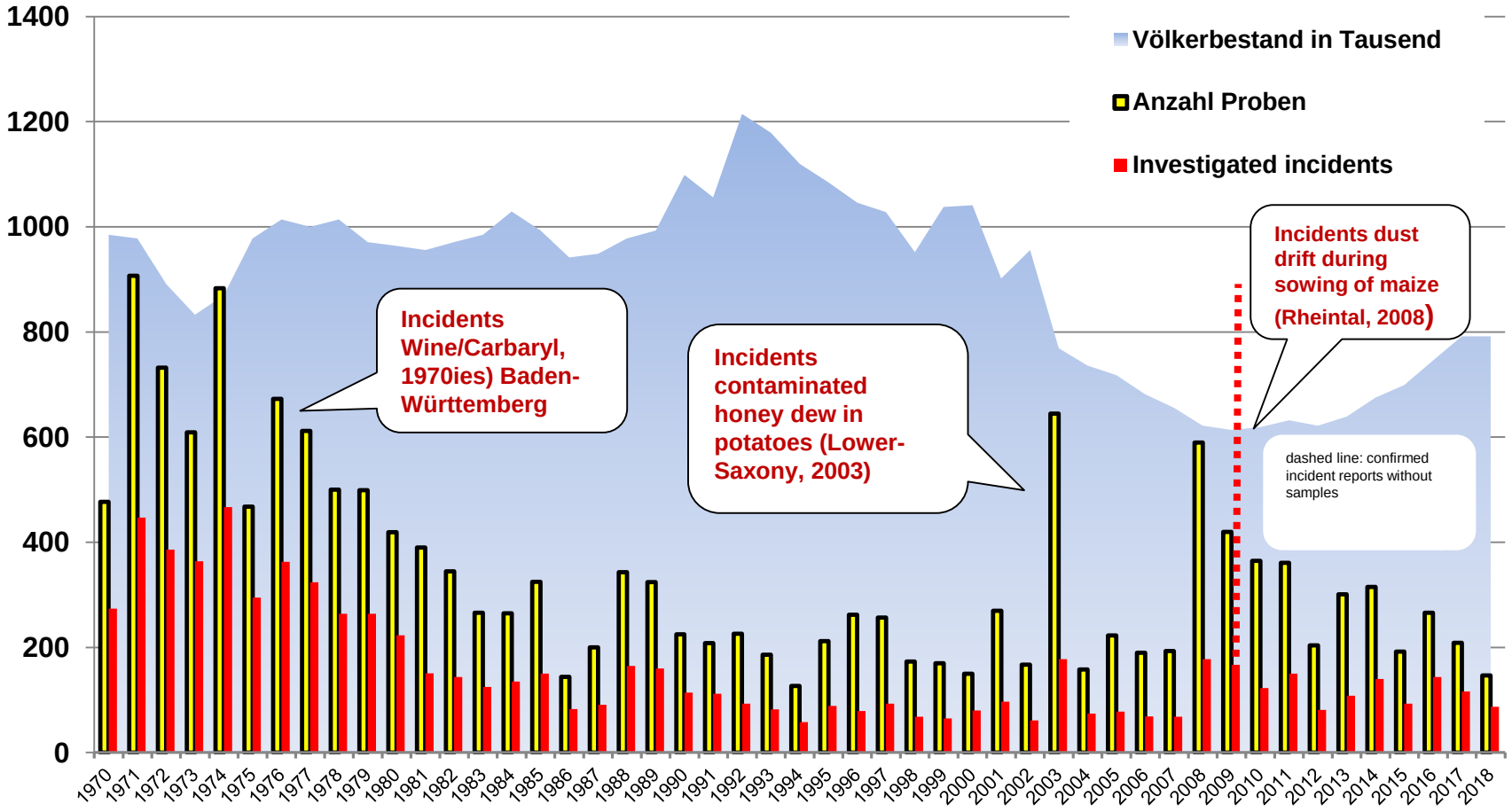




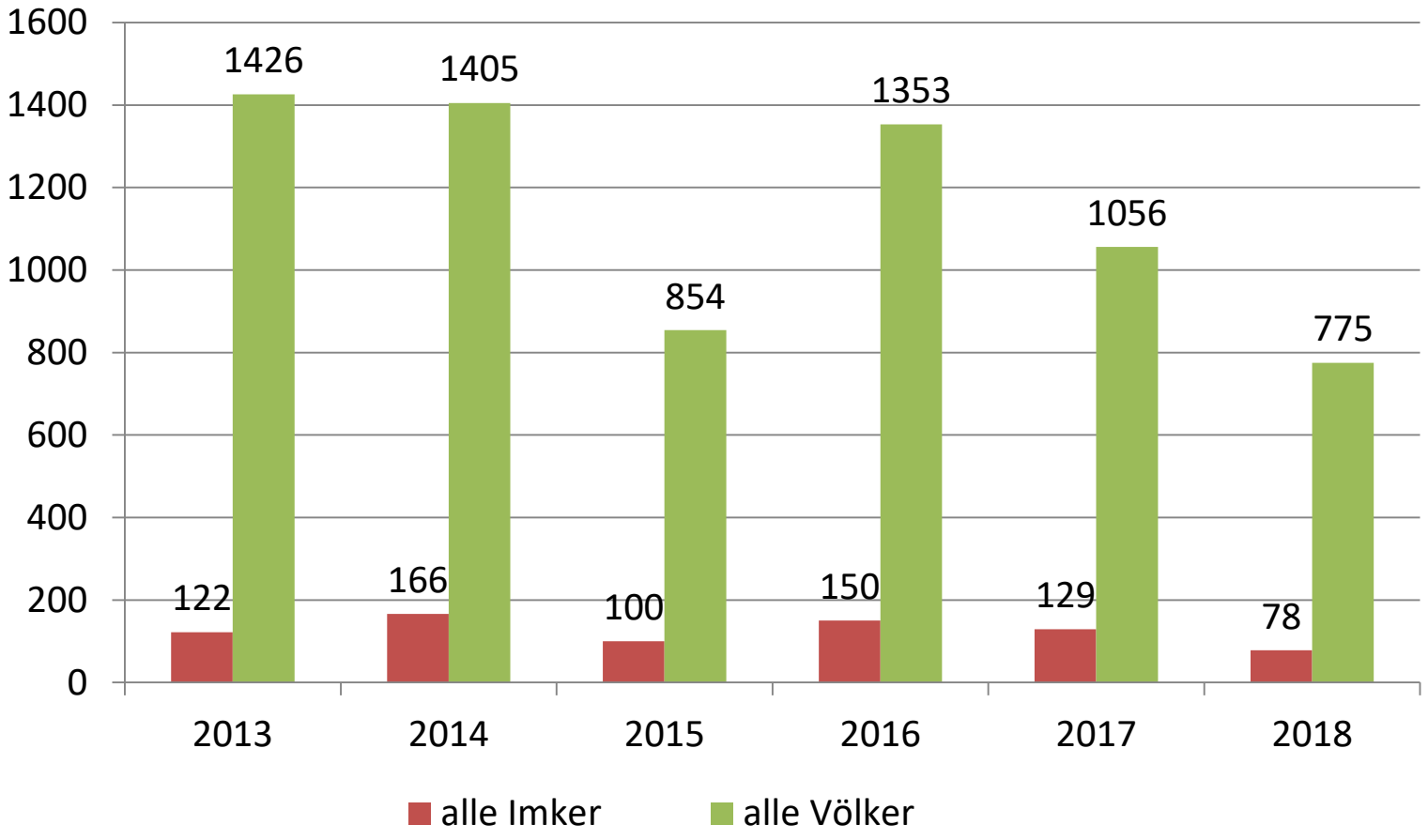
Bee Poisoning incidents, Germany

(Stand 29.11.2018)



Untersuchungsstelle für Bienenvergiftungen (UBieV) - Institut für Bienenschutz (BS)

Reported incidents :
Number of affected colonies (green bars) and beekeepers (Stand 29.11.2018)



Incident samples & Interpretation of residues

→ **Interpretation of toxicity, resiude levels, combination of different a.s. (active substances)**

Untoxic a.s. (almost all fungicides/herbicides)

- e.g. Boscalid, Terbutylazin, Metalaxyl-M, EBI-fungicides

Low to moderately toxic a.s (some insecticides)

- Thiacloprid, tau-Fluvalinat

toxic a.s. (most insecticides)

- Phosmet, Imidacloprid, Thiamethoxam, Chlorpyriphos, Cypermethrin

Synergist and toxic a.s

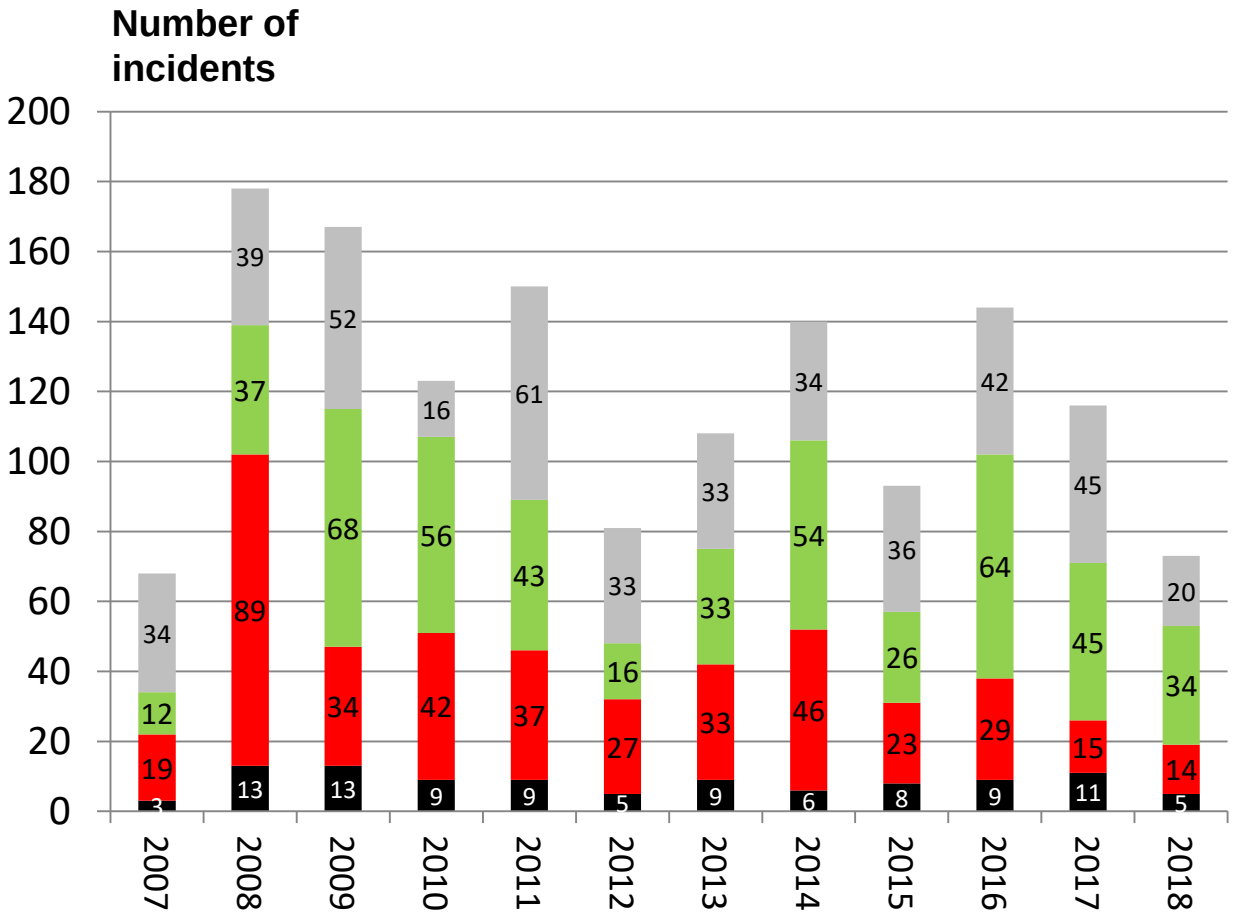
- PBO (Piperonylbutoxide: synergist with insecticides!)

Mixtures:

- Certain combinations with synergisms possible, e.g. Pyrethroids & EBI-fungicides)

→ **But: Few SLR-Data (subsequent residue levels) for interpretation of residues in dead bees and bee incidents available**

Conclusion on the analyses 2007 - 2018



No chem. analyses, unsuitable Samples

No bee toxic PPP detectable

bee toxic PPP/Biocides detectable

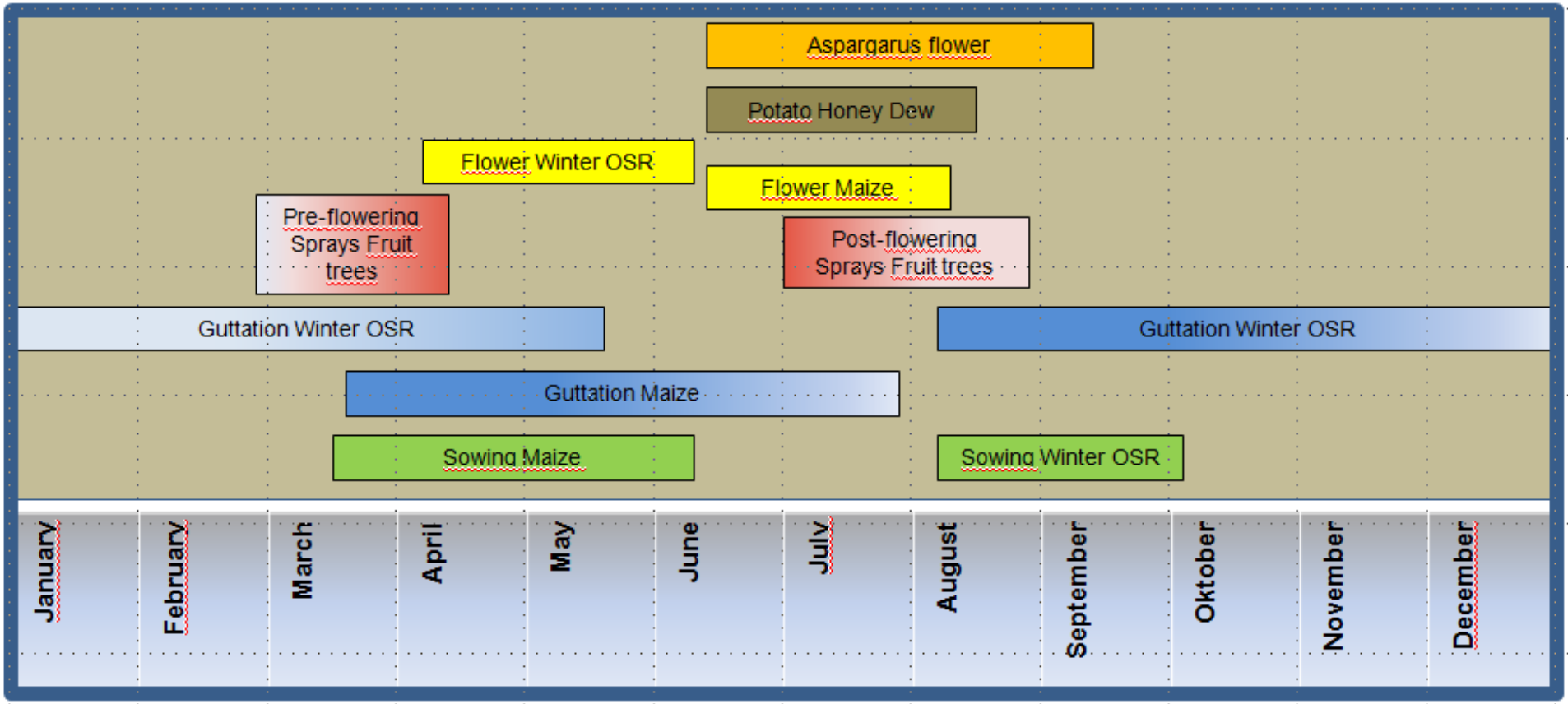
Fraud/deliberate Poisoning

Untersuchungsstelle für Bienenvergiftungen (UBieV), Institut für Bienenschutz (BS)

Active Substances-Top 10

Active	Rank	Total	2010	2011	2012	2013	2014	2015	2016	2017	2018
Dimethoat	1	63	4	18	7	10	13	3	4	2	2
Clothianidin	2	33	6	5	2	5	5	1	2	2	5
Fipronil	2	33	7	1	3	2	4	5	8	1	2
Chlorpyrifos	4	22	9	1	0	3	2	1	1	1	4
Imidacloprid	5	20	2	2	2	3	5	4	0	1	1
l-Cyhalothrin + Azol	6	19	0	0	6	4	2	3	2	2	0
Indoxacarb	7	18	2	2	2	2	5	0	3	1	1
a-Cypermethrin + Azol	8	13	2	2	3	2	2	0	2	0	0
Etofenprox	8	13	4	0	2	0	2	1	2	2	0
(z-) Cypermethrin	10	12	0	3	1	2	2	1	2	0	1

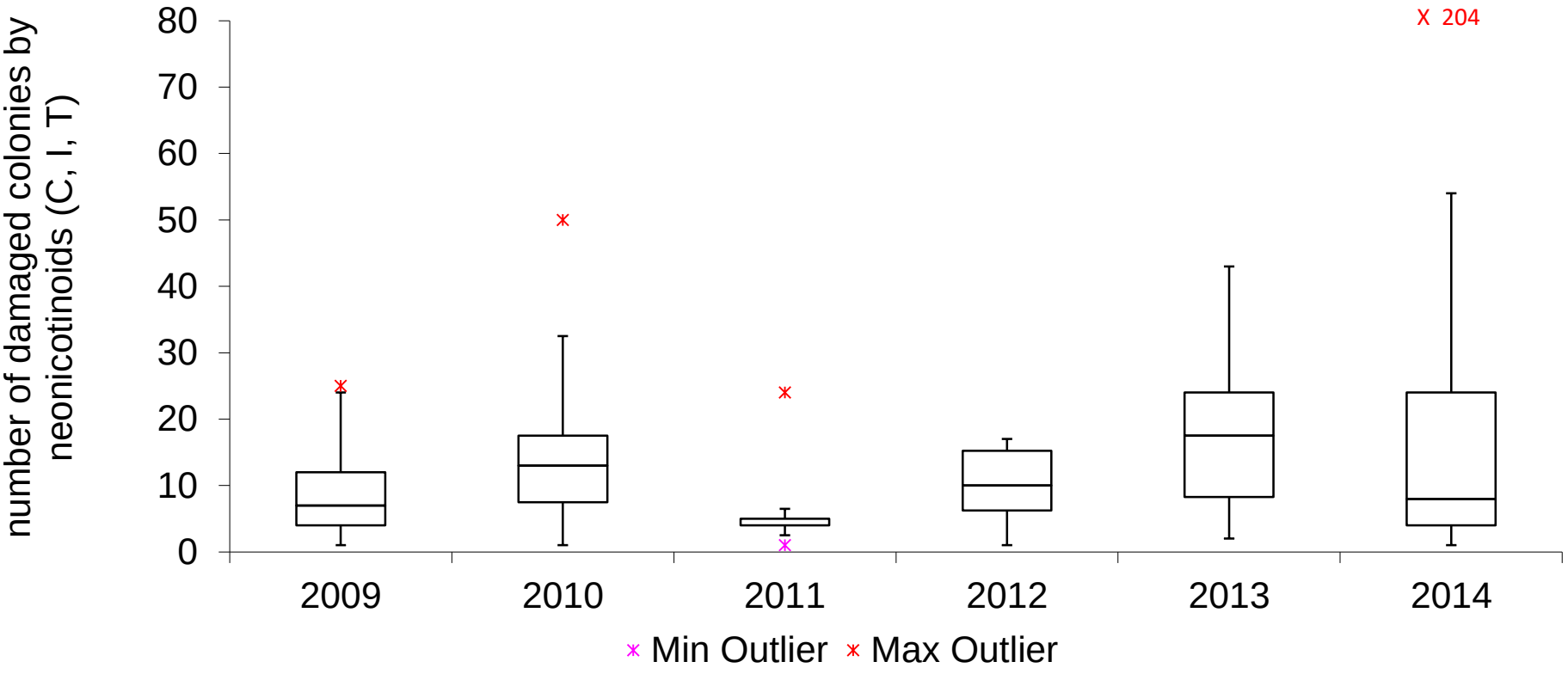
Potential exposure to pesticides over the year



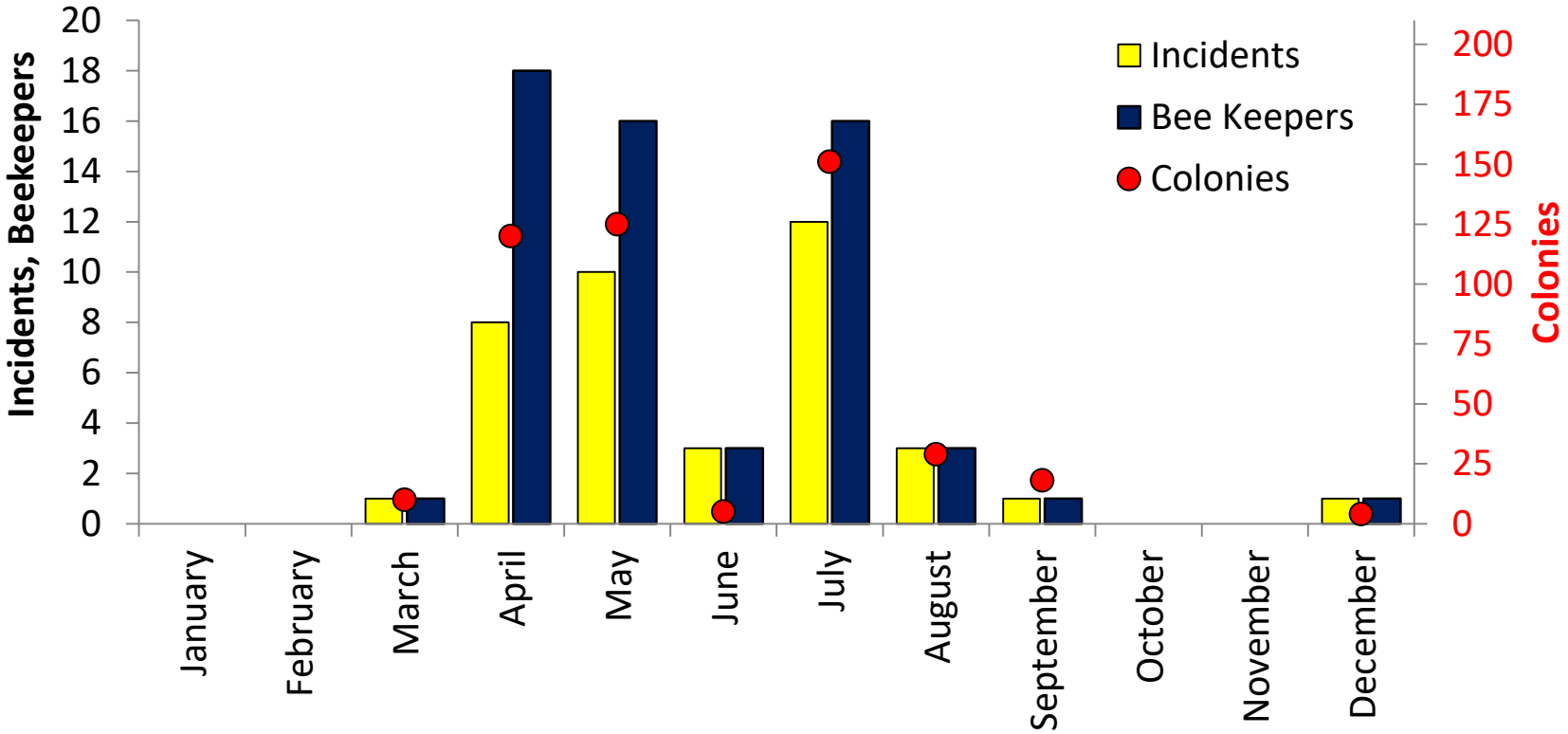
Incidents with Neonics: 2008 and thereafter

2008: 775 Beekeepers, ~ **12500** colonies damaged

- After incidents 2008 use of neonics in maize forbidden in DE
- Canola/OSR treatment and spray treatments registered uses until 2014.

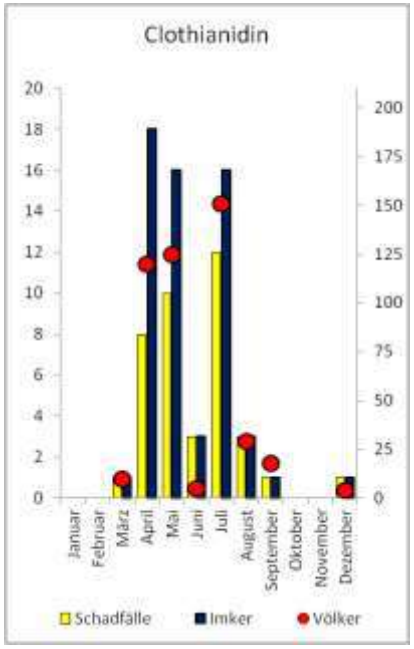


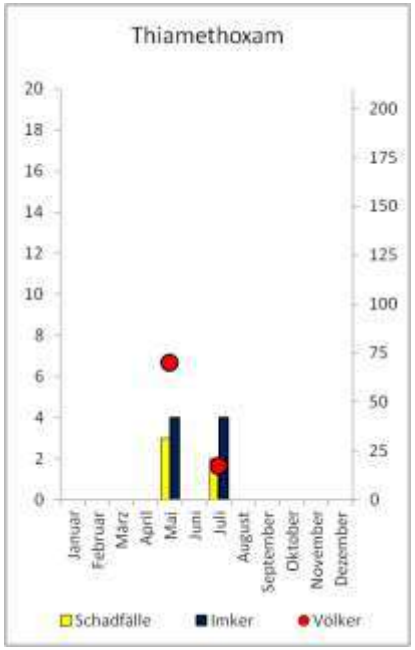
Incidents with Clothianidin 2009-2014

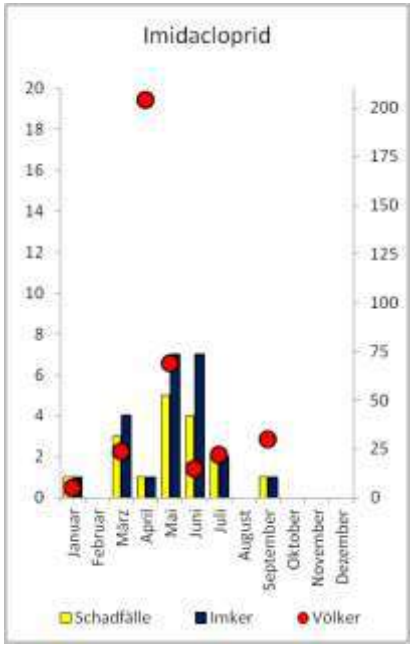


Further differention partially possible for some specific uses:
Winter Oilseed rape sown mid August- mid September.
Of 4 Incidents during sowing phase (09-14) no link with sowing anticipated.

Neonic´s







- Abb. 2 Primärachse: Verteilung der Anzahl Schadfälle (n=39) und Anzahl geschädigter Imker (59) mit positivem Nachweis von Clothianidin in den Monaten Januar bis Dezember im Zeitraum 2009-2014; Sekundärachse: Anzahl (462) als geschädigt gemeldeter Bienenvölker
- Abb. 3 Primärachse: Verteilung der Anzahl Schadfälle (n=5) und Anzahl geschädigter Imker (8) mit positivem Nachweis von Thiamethoxam in den Monaten Januar bis Dezember im Zeitraum 2009-2014; Sekundärachse: Anzahl (87) als geschädigt gemeldeter Bienenvölker
- Abb. 4 Primärachse: Verteilung der Anzahl Schadfälle (n=17) und Anzahl geschädigter Imker (23) mit positivem Nachweis von Imidacloprid in den Monaten Januar bis Dezember im Zeitraum 2009-2014; Sekundärachse: Anzahl (369) als geschädigt gemeldeter Bienenvölker

What causes acute mortalities?

- Most frequent causes of bee poisoning incidents with pesticides: **Misuse and Abuse of products**, ignorance of product label by the farmer, disregard of good agricultural practices
- **Poisoning incidents so far known for misuses of sprays, spray drift, tank mixes**, dust drift, but none for guttation
- „It“ is not „the neonic´s“- it is all about **specific risks for the different applications and intended uses**
- The potential **magnitude of effects is different for the different exposure routes**
- **Acceptability of effects** is different in different continents: acute effects may result in colony damage to losses, but depending on circumstances some effects can be compensated

Conclusions

- *A number of pesticide poisoning incidents is reported every year.*
- *But- likely that not all incidents are reported and samples sent in for analysis.*
- *Not all reported incidents are due to pesticides.*
- *In about 20 - 50 % (in regular years) of received samples we can conclude on causality or involvement of pesticides. In some years with, e.g. 2003 & 2008 this fraction was even a lot higher.*

International activities

- Increased awareness of the problem „pollinator decline“
- Global activities such as IPBES that sum the state of art to inform public and policy makers
- International scientific networks WGs such as COLOSS
- International regulatory/scientific networks, such as ICPPR
- International gremia of countries, such as OECD
- FAO
- International but often continent related activities such as monitorings and initiatives- many EU countries have a „pollinator protection plan“, EFSA (European Food Safety Agency)

IPBES

z.B. IPBES, 2016: Global Pollinator assessment report

OECD

Pesticide Effects on Insect Pollinators (PEIP) expert group

Objective: toolbox for risk assessment, risk management and incident reporting about pollinators

- Theme 1: Communicating pollinator incidents
- Theme 2: Pollinator test guidelines
- Theme 3: Pollinator risk mitigation
- Theme 4: Communication on pollinator research

ICPPR - International Commissior Plant Pollinator Relationships

- Mission since 1980: create, improve, validate, harmonize test methods + risk evaluation procedures, guidance development
- Forum to stimulate the scientific debate: regulatory authorities, scientists, industry, test labs, NGO, academia
- expert discussion on current and new issues (*e.g*. Dusts, Guttation, Non-*Apis*, Microbials,…) and their relevance for single bees and bee colonies and wild bees
- Initiation and Organization of Ring-testing and validation

Next Meeting of the Bee Protection Group:

23-25th Oct.2019, Bern, Switzerland – HOPE TO SEE YOU THERE!!!

Thank you for your attention!

Julius Kühn-Institut
Federal Research Centre for Cultivated Plants