



Buijs Agro-Services



Declining meadow bird populations and the presence of pesticides in livestock farming

Results of an investigation at 25 farms in the Province of Gelderland

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NIOO, Wageningen

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Het onderzoek in de Provincie Gelderland is mogelijk gemaakt dank zij de financiële ondersteuning van de Provincie Gelderland. Mede financiering door Buijs Agro-Services, ETS-Nederland en WECF-Nederland via het MESA programma van de Europese Unie

Motive for the research in Gelderland

- Disappearing meadow bird populations in almost all meadow bird areas, including those with a protected status.
- Populations of many birds decrease by multiple percentages per year, without a uniform common cause.
- All protection measures so far cannot reverse the tide.

Hypothesis of the research

- Pesticides are present at livestock farms in insect relevant quantities that adversely affect the chances of survival of bird chicks
- Duration of research: June 2018-April 2019

Innovative elements of this research

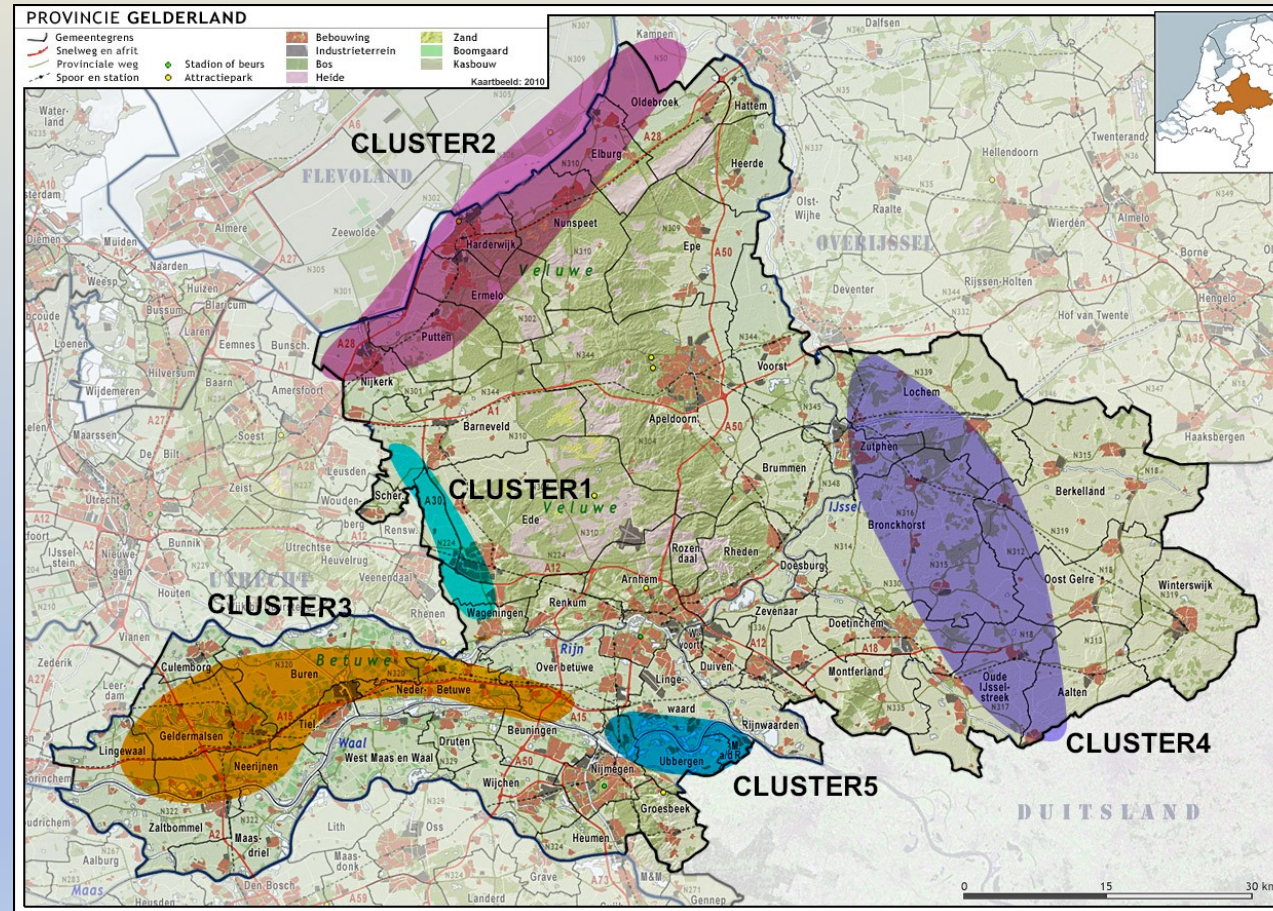
- a) Practical research into the presence of pesticides in manure, soil and concentrated feed; Analysis of 664 pesticides and 21 anti-parasitic drugs
- b) Collection of information on farm operations
- c) Lower quantification limit (LOQ) for pesticide analyses, instead of 10 micrograms/kg. Concentrated feed and soil: 1 micrograms/kg (10 times more accurate than usual) and manure 0,1 micrograms/kg (100 times more accurate than usual)
- d) Link ecological observations to results of chemical analysis

Criteria for the choice of farms

- Representative for Gelderland and possibly in clusters
- High and low stocking density
- Biological, bio-dynamic and conventional farms
- Participation in Meadow bird protection programs
- Bird counts data available in NDFF
- Wish by farm owner to participate in this research

Farms were contacted by the coordinators of bird working groups or directly by us

Five clusters with 25 participating farms 14 Conventional, 7 organic and 2 B.D. farms and 1 conventional tree nursery



Sampling slurry for analysis on 664 pesticides and 21 anti-parasitic drugs (including metabolites)



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Sampling of the most used feed concentrate



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Sampling soil: 20 samples per field of 0-20 cm over diagonals



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Observations in the field



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Beetle (*Sphaeridium scarabaeoides*) at work



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The manure on most of the farms; no signs of insect life



Information obtained from farm managers

- All participating cattle farms use grass as a basic feed, plus purchased concentrated feed and often own silage corn
- Almost all farms buy conventional bedding, 2 farms do not
- Most of the cattle farms use means against flies in the stable, milk space or means against worms (liver flukes, pulmonary worm etc.)

Number of pesticides found in the Gelderland livestock sector

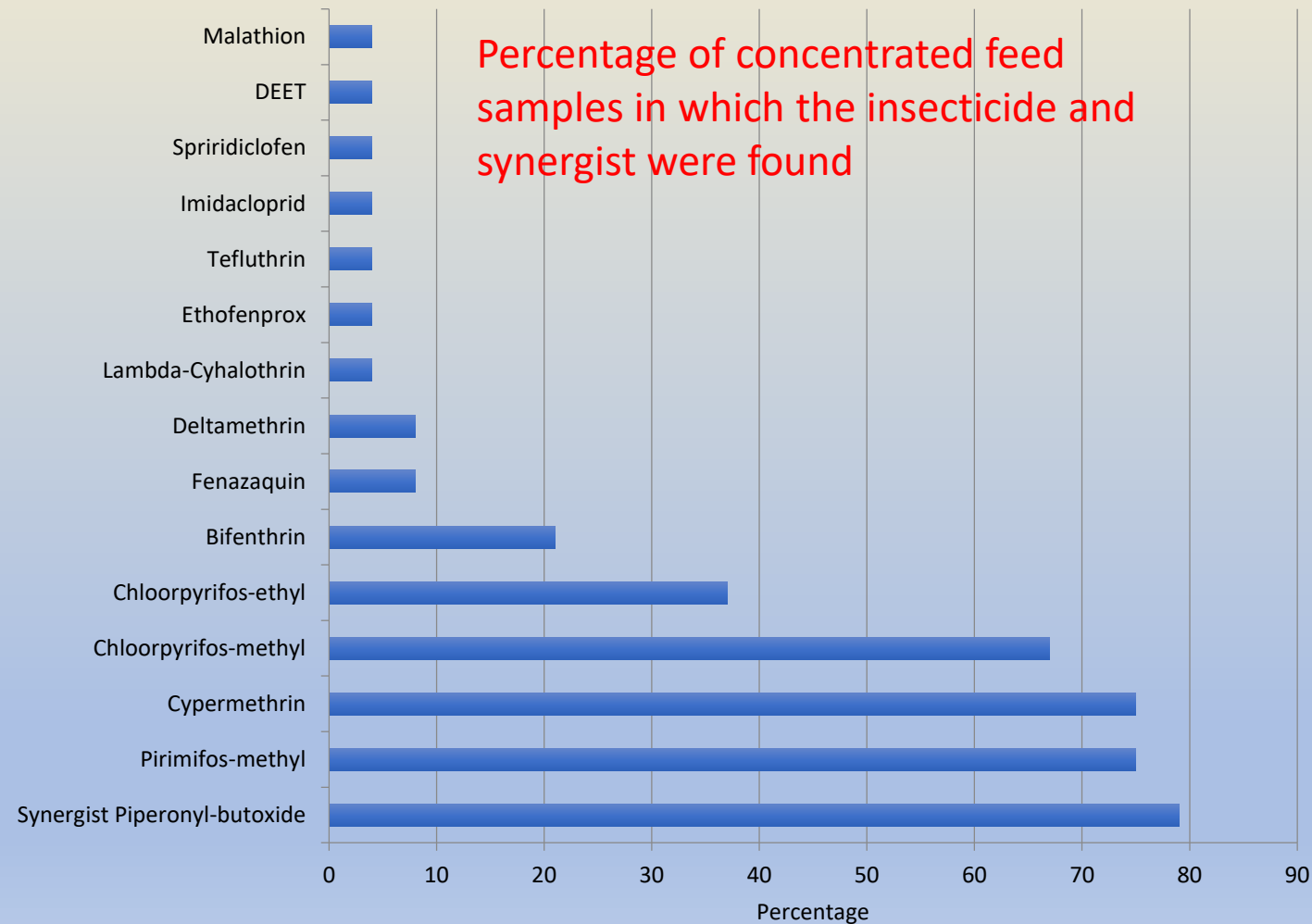
In total, 134 different substances were found on the 25 farms:
on organic farms 71 and on conventional farms 116 different substances S

	Manure	Among which insecticides	Soil	Among which insecticides	Feed concentrates	Among which insecticides	n
Average organic	12,3	1,44	5,0	1,33	8,6	2,5	9
Average conventional	16,7	3,25	4,1	0,31	13,9	3,9	16
Insecticides indicated including the synergist piperonyl-butoxide							

Quantities of pesticides in livestock farming (micro gram/kg)

	Manure fresh	Of which insecticides ³	Soil	Of which insecticides ³	Concentrated feed	Of which insecticides ³	n
Average organic	130,6 ¹	37,6 ⁴	51,0	16,2 ²	261,3	8,4	9 farms
Average conventional	146,3	15,6	88,8	1,9	997,1	212,7	16 farms
1 dry matter content of this manure is on average 30% higher 2 < 1 if farm № 2 in flood plain of Waal is excluded, with 103.3 micro gram/kg soil 3 including the Synergist piperonyl-butoxide 4 without one very polluted organic farm with Spirodiclofen (311 ug/kg) is the average 3.1 ug/kg							

Insecticides in cattle feed



Average levels of glyphosate and AMPA in manure, feed and soil on the holdings examined in Gelderland (in micrograms per kg of wet weight)

	Manure		Concentrated feed		Soil	
	glyphosate	AMPA	glyphosate	AMPA	glyphosate	AMPA
Average content (µg/kg)	30	11,9	402,1	116,5	5,7	46,3
9 organic farms	0,9	6,8	160	58,2	1,1	24,1
8 organic farms (excl No24)	0,5	8,5	0	9,0	0	16,2
16 conventional farms	46,4	14,9	569,2	154	9,5	67,1

AMPA=Aminomethylphosphonic acid

Standards for pesticides in food and feed

- Maximum residue limits (MRL) per product and per substance are laid down for agricultural products for human consumption.
- If the product is also used as feed such as wheat, maize or soy, this standard also applies to cattle feed

The MRL standards take into account human health, but not the ecological effects of residues/excretions in the manure.

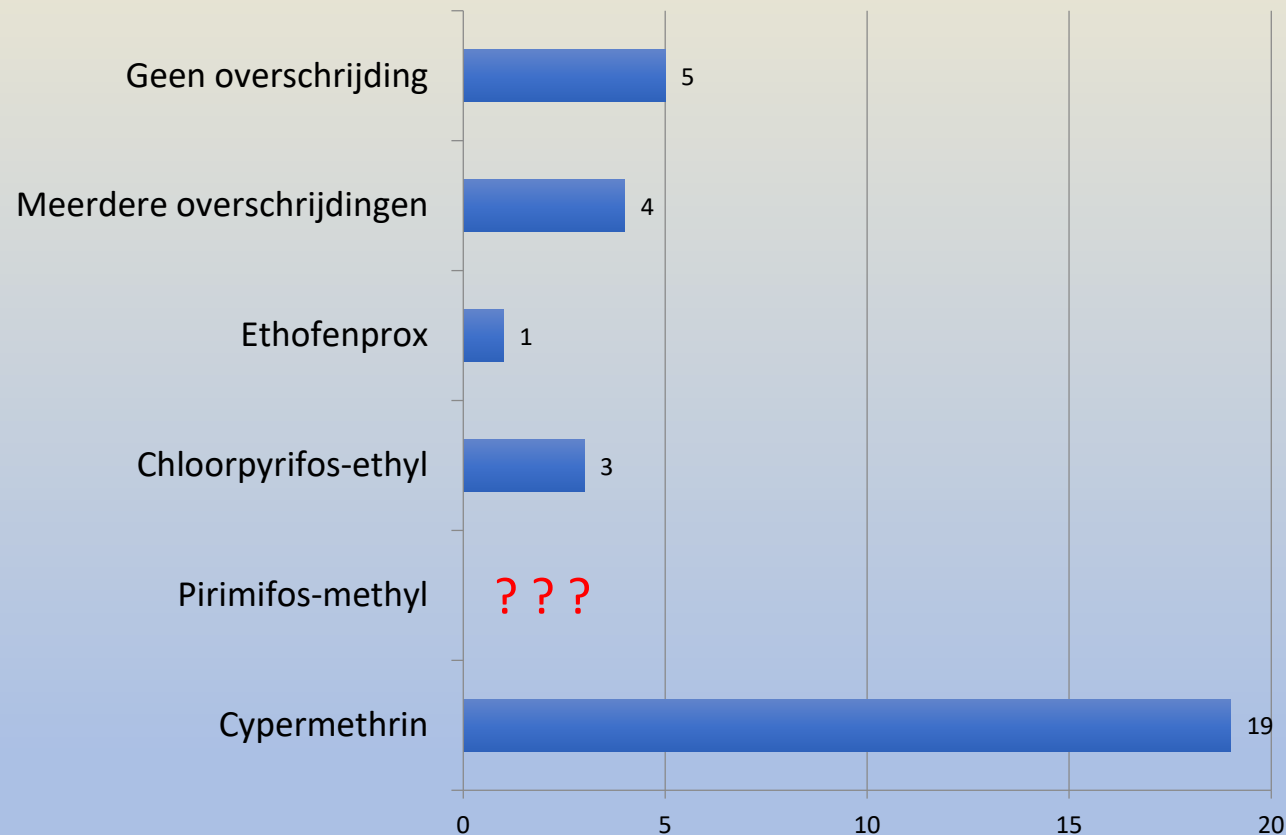
There are no legal standards for permitted levels of pesticides for: Fodder such as grass, hay, beet pulp, soil or livestock manure (excluding fipronil in chicken manure).

LR50 value is used as indicator for impact on non-target insects and other test organisms

- Lethal Rate (LR50): Number of grams of pesticide applied per hectare where half of the (above ground) test organisms die within a certain period (usual 48 or 72 hours)

SUBSTANCES OF WHICH LR50 IS EXCEEDED WITH FEED (26 SAMPLES)

(calculated according to the use of feed per hectare per year)



Taken into account that:

- all manure is applied on the own land
- that insecticides are not accumulated in the animal
- that insecticides from the feed are not turned into metabolites without insecticidal effect

WHAT DETERMINES THE TOXIC EFFECT?

- Concentration
- Toxicity
- Persistence
- Harmfulness of metabolites
- Persistence of metabolites
- working mechanism of the substance
- Time dependency and dose/effect relation
- Bio-accumulation in the organism
- Accumulation in the food chain

Research of risks for the ecosystem

Indications

The comparison of the found concentrations with the ecological AA-EQS¹ and MTR² standards.

LR50 values are already exceeded for various test organisms by one simple manure gift.

Data from literature, for example Gilbert, MacGillivray, Robertson & Jonsson (2019) and Humann-Guillemot et al (2019).

Empirical

The measurements of the number of Coleoptera in fresh manure from the pasture and the statistically significant correlation thereof with the insecticide uptake and with the uptake of the total pesticides.

¹Average Annual Environmental Quality Standard

²Maximum Tolerable Risk

EXAMPLE: How much deltamethrin is needed to reach the AA-EQS for surface water for the entire IJsselmeer?



Answer: 16 grams

This drug is also permitted in organic (and biodynamic) agriculture as a veterinary medicine

The AA-EQS for deltamethrin = 0.0000031 micrograms/litre surface water

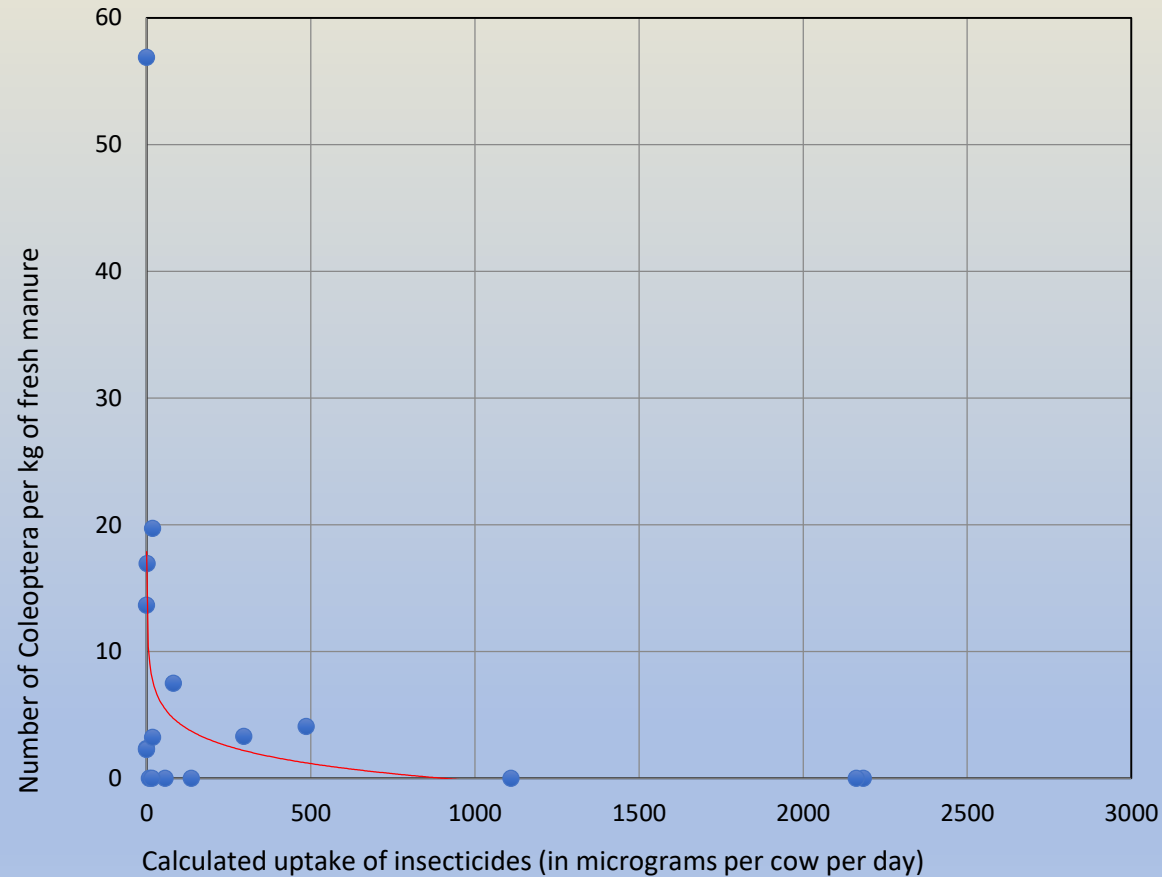
In slurry we find up to 11, 4 micrograms/kg; This is 3.6 million times the AA-EQS standard.

The detection limit is 0.1 micrograms/kg

Counts of dung beetles on 19 farms

- On 1 conventional farm we found a good population of dung beetles (57/kg) in the fresh manure in the field. This company used no feed concentrates at that moment.
- 3 other farms had more than 10 to 20 beetles per kg (including 2 organic without concentrated feed).
- At 9 farms no dung beetles were found at all and 6 companies only few (less than 7/kg).
- We may see on these 15 companies the effects of insecticides that come through the concentrated feed in the manure.

Correlation of insecticide uptake with concentrated feed and occurrence of Coleoptera in fresh manure



Results of statistical calculations

The number of living beetles in fresh manure from the pasture is significantly negatively correlated with daily insecticide uptake per cow

Kendall: Correlation coefficient = -0,361; $P = 0,05$

Spearman: Correlation coefficient = -0,493, $P = 0,038$

It has been assumed that the insecticides from the concentrated feed are present in the manure from the pastures

Comparison of correlation coefficients between the daily uptake of (different categories) of pesticides with beetle counts in 18 manure samples

Statistical test	Σ insecticides	Σ pesticides	Pirimifos-methyl and cypermethrin	Glyphosate and AMPA
Kendall	-0,361*	-0,351	-0,288	-0,248
Spearman	-0,493*	-0,491*	-0,382	-0,320
*significant at 5% level (two tailed)				

Interpretation

Only with a daily consumption of less than 25 micrograms of insecticide per cow per day we found a substantial number of Coleoptera in the manure

This means that with an uptake of 5 kg of concentrated feed/day/cow an insecticide content of less than 5 micrograms/kg concentrated feed

In the case of conventional feed, we found on average 212.7 and in organic concentrated feed 8.6 micrograms/kg

EXAMPLE: What amounts of pesticides are at present allowed to be present simultaneously in barley according to the MRL standards issued by the EFSA¹?

- 2 mg deltamethrin (insecticide)
- 2 mg cypermethrin (insecticide)
- 5 mg pirimifos-methyl (insecticide)
- 2 mg fluxapyroxad (fungicide)

¹*European Food Safety Authority*

What should we do to get on Max 5 micrograms of insecticide per kg feed?

- Introduce a standard for the maximum total level of insecticides and one for individual substances at least 1000 times lower than at present

Lapwings come to clean pastures with insects



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What we do not see:

Hundreds of pesticides that are no longer on the market and thousands of metabolites that are not measured in standard analysis packages;
The 135.3 microgram/kg found in manure is the tip of the iceberg that we see

Effects on the number of breeding pairs of meadow birds on the participating farms of this research

Period 2008-2018, 12 conventional and 4 organic farms

Type of farm	Average size (ha)	Number of breeding pairs of birds	Total number of farm counts	Average number of breeding pairs per count per company
Conventional	55,2	690	49	14,1
organic	60,1	1243	17	73

Source: NDFF database

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Explanation of bird counts

- On average, organic farms have many more breeding pairs of meadow birds
- On one organic farm and one in conversion more than half of all breeding pairs of meadow birds of all 25 farms were registered
- This applies to 3 out of 9 organic farms; Six of them are just as few as the 16 farms (!)
- Also on the three farms with many birds, godwits do not reproduce themselves and disappear other vulnerable species

Foraging lapwings on organic land (from cows that do not get factory produced feed concentrates)



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Sources of pollution of livestock farms

- Purchased litter (with fungicides, insecticides, herbicides)
- Concentrated feed and fodder
- Self-purchased veterinary medicines and means of fly control
- Drinking water from contaminated surface water
- Use of contaminated sludge from ditches
- Pollution by previous generations of farmers who have worked on the farm (for example: DDT, AMPA, Propoxur, Pentachlorobenzene, etc)
- Drift from other farms/regions: Chlorpropham, DEET, Fluxapyroxad, BAC12, BAC14, DDAC etc?

Insect and bird protection

- Can we continue with the existing Bird protection programs in the old manner?
- After 25 years of bird protection, the meadow bird populations continue to deteriorate (with few exceptions).
- Insect diversity and mass decreases; Also in large nature areas such as the Dwingelderveld,
- As long as insecticides and other substances pollute pastures, fields and natural areas, insect populations are likely to deteriorate further.

The research results are confirmed by findings of other researchers

- The cumulative effect and persistence of neonicotinoïdes, pyrethroids, organophosphates and fungicides at extremely low concentrations can lead to dramatic damage (Tennekes, 2010; Humann-Guilleminot, 2019)
- An anti-parasite treatment of cattle with deltamethrin and triclabendazole causes a reduction of 86% of larvae of arthropods in manure (Gilbert, Mac- Gillivray, Robertson & Jonsson, 2019)
- The survival of Lapwings's chicks is currently completely inadequate for the population to survive. Availability of food is the crucial factor to improve the survival of lapwing chicks (Teunissen en van der Jeugd, 2018)
- A lapwing chick needs 800-5000 prey arthropods per day; A tailed godwit young 2000-10.000 (Factsheet Kievit, Factsheet Grutto, 2016).

Persons who reviewed report sections:

- professor Jan Diek van Mansvelt
- professor Ad Ragas
- professor Frank Berendse
- professor Martin van der Berg
- professor Marcel Dicke
- ir. Gerard Oomen
- Dr. Henk Tennekes

Comments from WER/WUR

- We are not allowed to add up concentrations of different insecticides
- Statistical testing in the report has not been fully explained
- Causal relationships of correlated parameters not proven
- No data about the number of chicks, their development and survival
- Analytical chemistry not fully transparant
- The explored LR50 values are not suitable for risk assessment in this research
- The topic of this research has been neglected so far by official institutes
- In spite of given critics, it cannot be excluded that pesticides in feed do have negative influence on insect and bird populations

High unawareness of the issue:

- Wherever you are going to measure, you will find totally unexpected serious contaminations, also on organic farms, DDT, Spirodiclofen, Propoxur, Thiacloprid, Deltamethrin, Fluxapyroxad...
- Farmers and traders who are totally unaware of the undesirable substances in the feed
- Conservationists who are unaware of the pollution of their meadow bird lands
- Traders and farmers cannot anticipate the facts because all the facts are kept hidden, or because no research is being done
- The chance is therefore very high that contaminations will increase, because everyone puts their heads in the sand. Insects and birds do not disappear accidentally; Ecological damage accumulates. Even on the organic farms with most breeding birds, species disappear or can no longer raise a chicks
- It is likely that it will take long before ecological recovery can occur; Many of the substances found remain in the soil for decades, and circulate through the silage throughout the farms

Thank you for your attention

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Report is available at: WECF.NL

