



## Weed seed collection with a combine harvester as approach for non-chemical weed control in central Hessen, Germany

Supervision: Prof. Dr. Rainer Waldhardt  
Presenter: Philipp Köllmann

Department of Landscape Ecology and Landscape Planning  
Justus-Liebig University Giessen

# Relevance

- Increasing application of herbicides
- Increasing demand for alternative weed control measures
- Resistances for herbicides
- *Alopecurus myosuroides*, *Lolium spp.*

## CHAPTER 34 PREVENTION AND CONTROL OF HERBICIDE RESISTANT WEEDS IN AUSTRALIA

### Abstract

### Harrington Seed Destructor: A New Nonchemical Weed Control Tool for Global Grain Crops

Michael J. Walsh,\* Raymond B. Harrington, and

RESEARCH

and dicot weed  
) has developed  
erefore, has had  
vely short-lived



Weed Technology

www.cambridge.org/wet

#### Research Article

**Cite this article:** Soni N, Nissen SJ, Westra P, Norsworthy JK, Walsh MJ, Gaines TA (2020) Seed retention of winter annual grass weeds at winter wheat harvest maturity shows potential for harvest weed seed control. *Weed Technol.* 34: 266–271. doi: 10.1017/wet.2019.108

Received: 4 June 2019

### Seed retention of winter annual grass weeds at winter wheat harvest maturity shows potential for harvest weed seed control

Neeta Soni<sup>1</sup>, Scott J. Nissen<sup>2</sup>, Philip Westra<sup>2</sup>, Jason K. Norsworthy<sup>3</sup>, Michael J. Walsh<sup>4</sup> and Todd A. Gaines<sup>5</sup>

<sup>1</sup>Graduate Student, Department of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins, CO, USA; <sup>2</sup>Professor, Department of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins, CO, USA; <sup>3</sup>Professor, Crop, Soil and Environmental Sciences, University of Arkansas Fayetteville, AR, USA; <sup>4</sup>Director of Weed Research, Plant Breeding Institute, University of Sydney, Narrabri, Australia and <sup>5</sup>Associate Professor, Department of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins, CO, USA

**BioOne** COMPLETE

### Chaff collection reduces seed dispersal of wild oat (*Avena fatua*) by a combine harvester

Authors: Shirliffe, Steven J., and Entz, Martin H.

Source: *Weed Science*, 53(4) : 465–470

Published By: Weed Science Society of America

URL: <https://doi.org/10.1614/WS-03-109R2>

# Project goals



Reduction of weed pressure



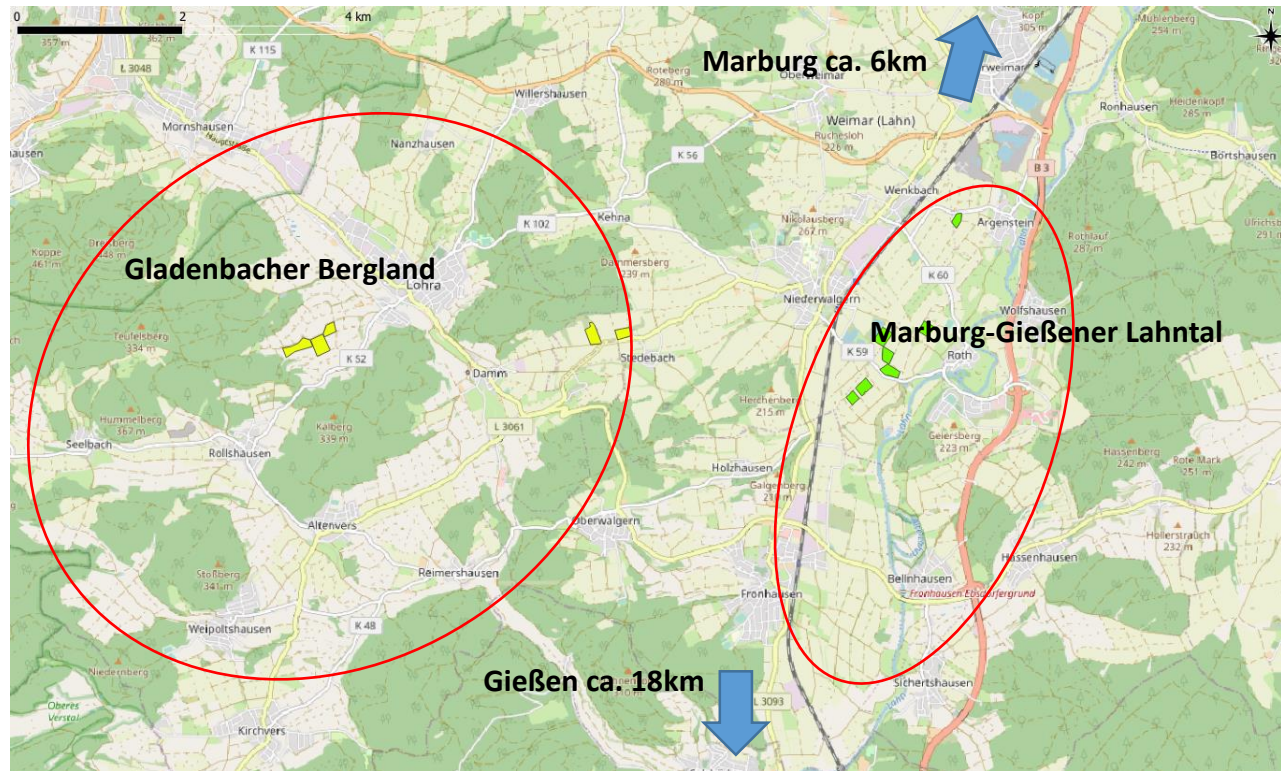
Developing and testing  
of a new combine  
harvesting technique



Capturing arable plant seeds for  
conservation measures



# Research area



- 42 sites
- 2 landscape areas
- 22 Fields along the former Lahn river valley
- 20 Fields in the region around Gladenbach
- Equally divided into conventional and organic managed fields

# Research questions I/II

## *I Composition of arable weed species*

- Which factors (area, management, soil depth) do have a relevant impact on diversity indices?
- In how far do differences exist between organic and conventional fields with regards to species composition and species richness?
- Which effect does the farming practice have on current coverage of arable weeds and on the potential arable weed flora in the soil (soil seedbank)?
- Do landscape areas have their characteristic indicator species?

# Analysis of vegetation ecological aspects

## Material and Methods

Analysis of the soil seedbank

- Sampling of six samples per field in 2018/19
- Division into two soil depths 0-5 and 5-20cm
- Transfer into seedling trays
- Identification of arable weed species 2 – 3 weeks after seedlings emergence.



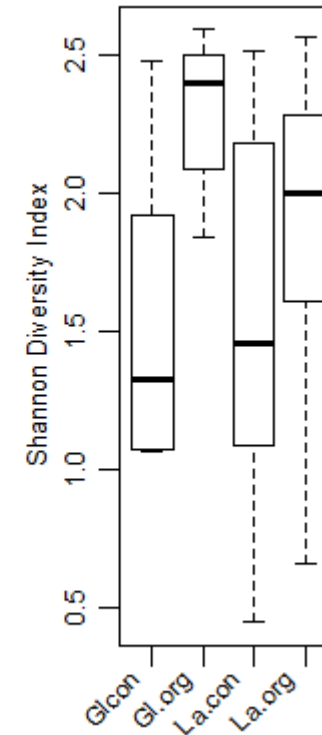
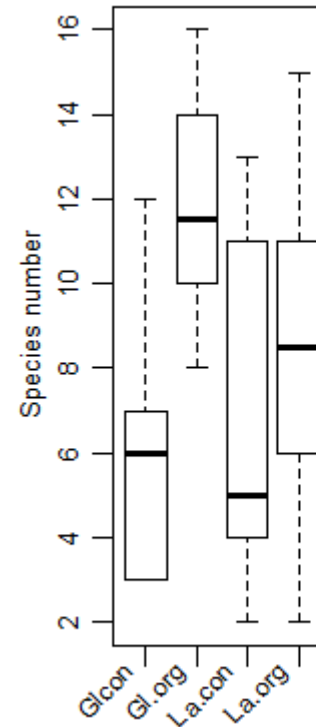
## Material and Methods

- ***Analysis of current weed flora***
- Permanent plots (15x40m) for observing weed flora on the field
- No herbicides on these plots to ensure growth of weeds
- Relevés in spring and summer
- Documentation of current weeds on the scale of Braun-Blanquet

# Analysis of vegetation ecological aspects

## *Releve data*

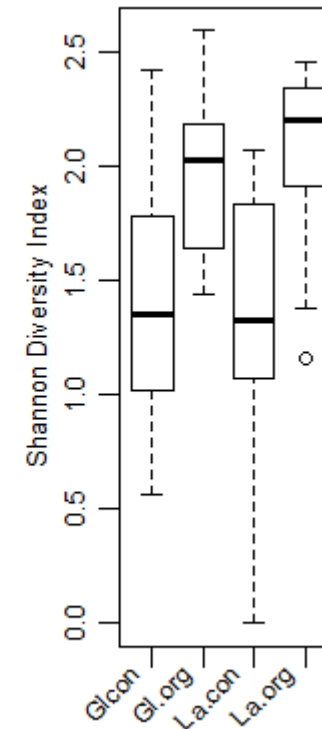
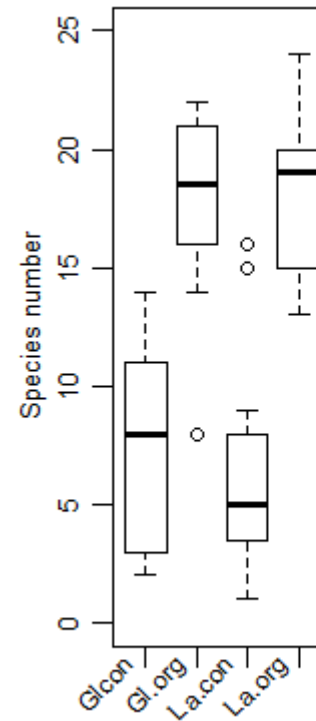
- Species numbers: organic >> conventional
- Significant effect of management system on species numbers
- Species numbers reach values around twice as high as those in conventional cropping



# Analysis of vegetation ecological aspects

## *Soil seedbank*

- Species numbers: organic >> conventional
- Significant effect of management system on species numbers
- Soil seedbank reflects the conditions of current vegetation
- Soil seedbank is depleted under long-term conventional practice





# Analysis of vegetation ecological aspects

Characteristic weeds on the fields – Indicator species



Site group	Indicator species		Stat.	p-Value(Significance)
GI-org	<i>Arabidopsis thaliana</i>	Ackerschmalwand	0.775	0.002 (**)
	<i>Papaver rhoeas</i>	Klatschmohn	0.701	0.002 (**)
	<i>Papaver dubium</i>	Saatmohn	0.632	0.007 (**)
La-org	<i>Anthemis arvensis</i>	Acker-Hundskamille	0.886	0.001 (***)
	<i>Vicia hirsuta</i>	Rauhaarige Wicke	0.880	0.001 (***)
	<i>Rumex crispus</i>	Krauser Ampfer	0.755	0.005 (**)
	<i>Sonchus asper</i>	Rauhe Gänsedistel	0.693	0.001 (***)
	<i>Erysimum cheiranthoides</i>	Acker-Schöterich	0.632	0.006 (**)
GI-org + La-org	<i>Tripleusperrum inodorum</i>	Geruchlose Kamille	0.909	0.001 (***)
	<i>Myosotis arvensis</i>	Acker-Vergissmeinnicht	0.866	0.001 (***)
	<i>Veronica arvensis</i>	Acker-Ehrenpreis	0.804	0.002 (**)
	<i>Trifolium repens</i>	Weißklee	0.789	0.002 (**)
	<i>Alopecurus myosuroides</i>	Ackerfuchsschwanz	0.768	0.012 (*)
	<i>Trifolium pratense</i>	Rotklee	0.707	0.006 (**)

# Analysis of vegetation ecological aspects

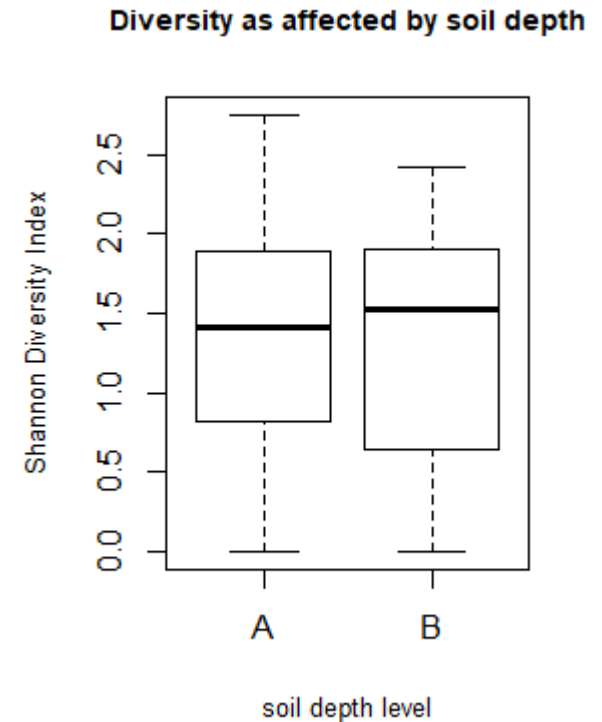
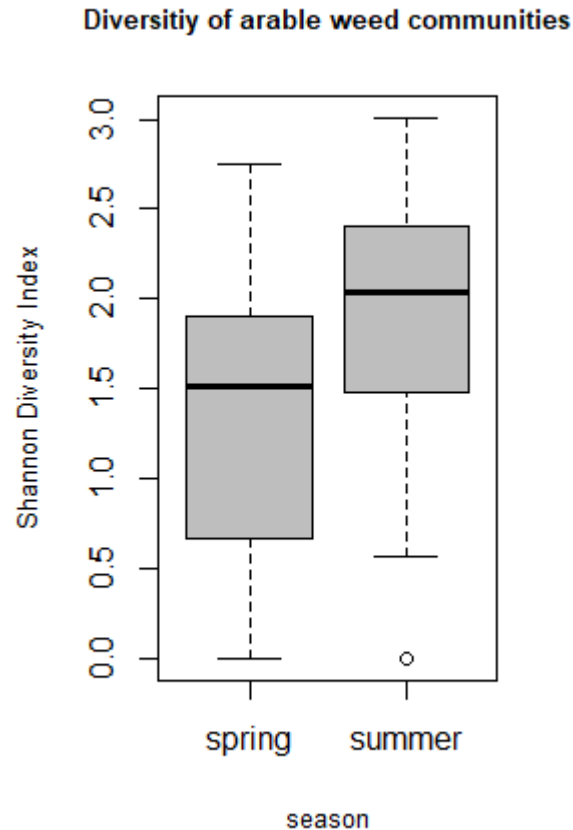
## *Soil seedbank*

### *Effect of the season*

- By trend higher species numbers during summer months

### *Effect of the soil depth*

- No significant impact of soil depth (plowing and mixing of soil layers)



# Research questions I/II

## *II Testing of a equipment to collect weed seeds during combine harvesting*

- Is the new device suitable for collecting weed seeds and thus could be effective to reduce weed seed inputs to the soil seedbank and consequently, to reduce weed pressure?
- Which efficiency can be achieved with this new technique?
- Which share of seeds can be caught?
- Which weed species can be collected?
- Does the landscape area affect weed seed capture rates?

# Material & Methods

- Choosing a suitable field with a high coverage of the target species
- Here: winter rye – field with *Bromus hordeaceus*
- Three stripes á 7.6m x 20m were harvested
- Capturing of chaff and weed seeds in a separate container, placed at the rear of the combine harvester
- Capturing released weed seeds with a foliage



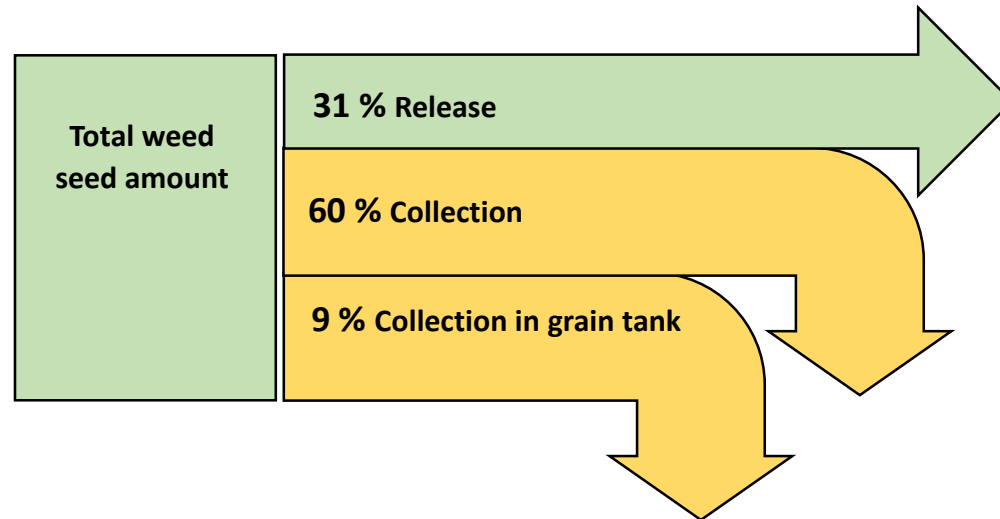
# Material & Methods

- Transfer of 10g chaff and seeds into trays
- Identification of arable weed species 2 – 3 weeks after seedlings emergence.

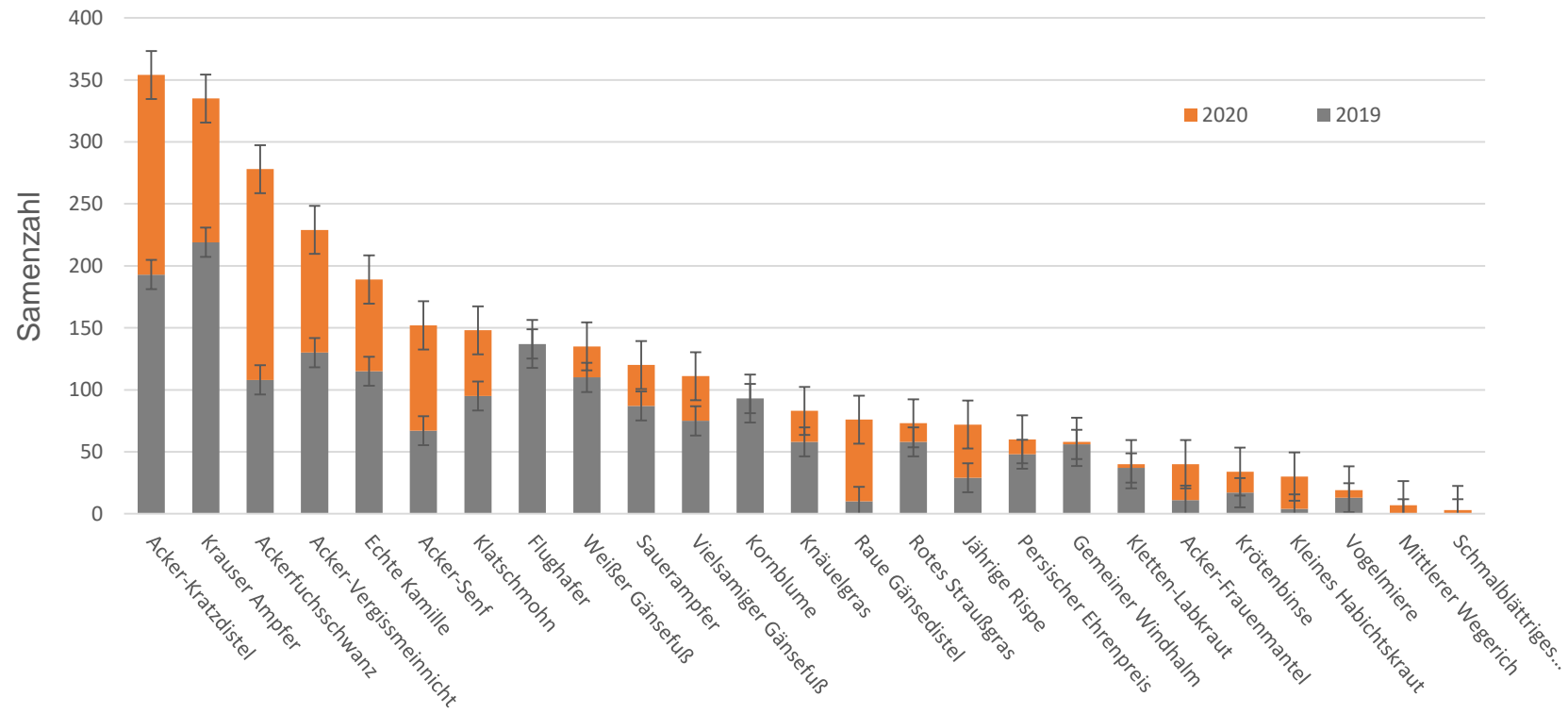


# Results of the field trial

- An analysis of the pathways of weed seeds in the combine harvester
- Main proportion (60%) was collected

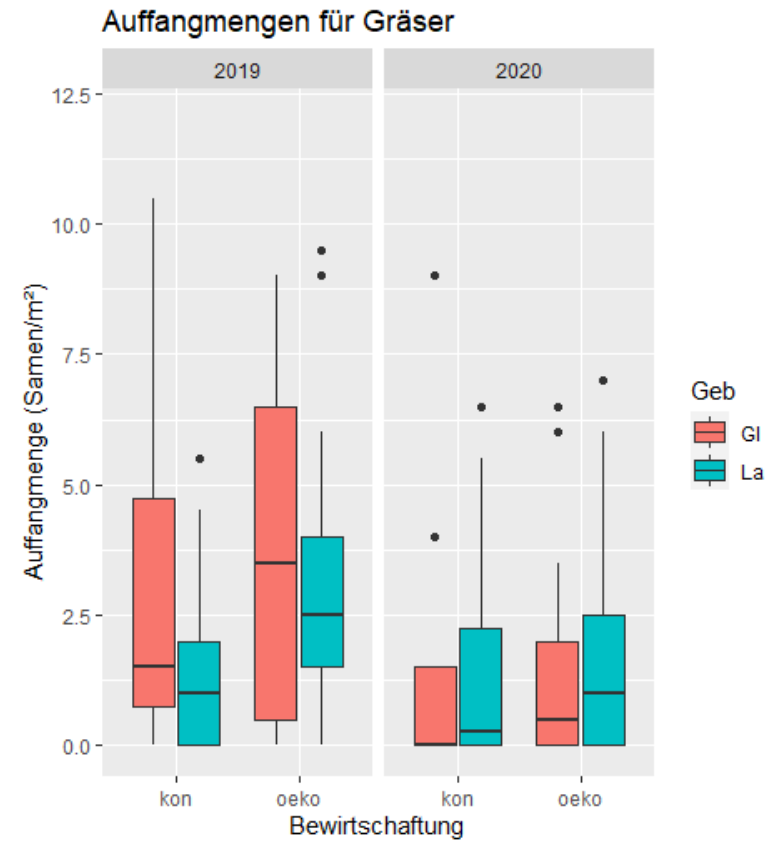


# Spectrum of collected weed seeds



# Collection rates for grasses

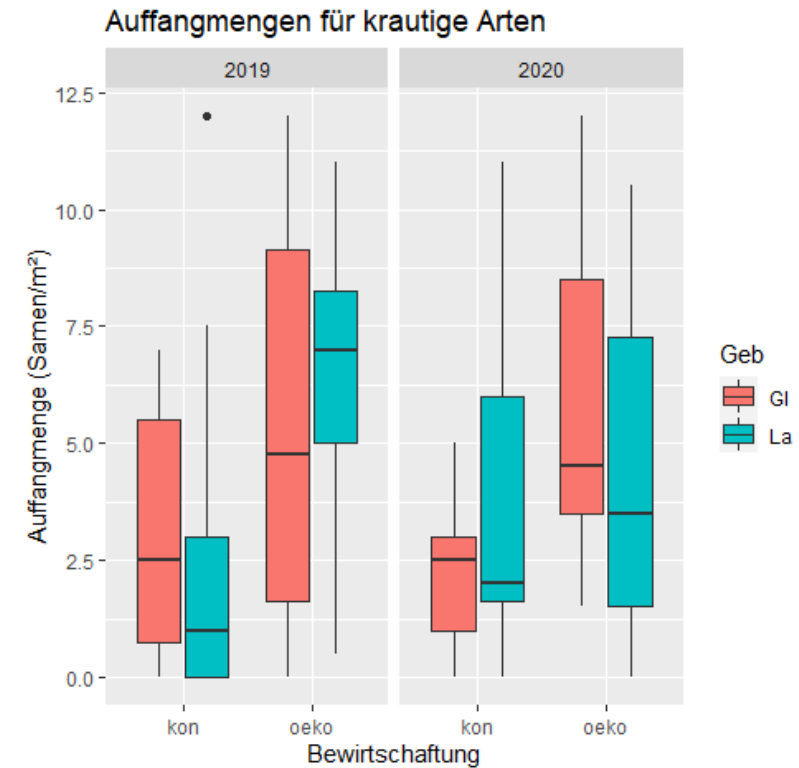
- By trend higher rates in 2019 than in 2020
- Higher weed seed yield in organic cropping systems
- Area is not significant





# Collection rates for grasses

- Higher collection rates in the variant 2019-öko
- Higher variance between herbal and grass species



# Conclusion & prospect II/II

- Weed seed collection was tested to be an effective tool to collect and to reduce weed seeds from arable fields
- For grasses, a main proportion of 60% of the current weed seeds could be retained
- There are differences in the collection rates between grasses and herbal species
- Capturing of annual species which show a similar mature timing like the crop



Thank you for your attention!

