# ORGANIC AND BIODYNAMIC VITICULTURE ENHANCE BIODIVERSITY


OENOBIO

INTERNATIONAL CONFERENCE

Organic vines and wine advancement and challenges

With the support of :

OIV Sous le patronage de l'Organisation Internationale de la Vigne et du Vin

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# Importance of Biodiversity in viticulture

**Sustainable management is one of the major challenges of agriculture and viticulture.**

**The micro- and macrofauna of vineyards**

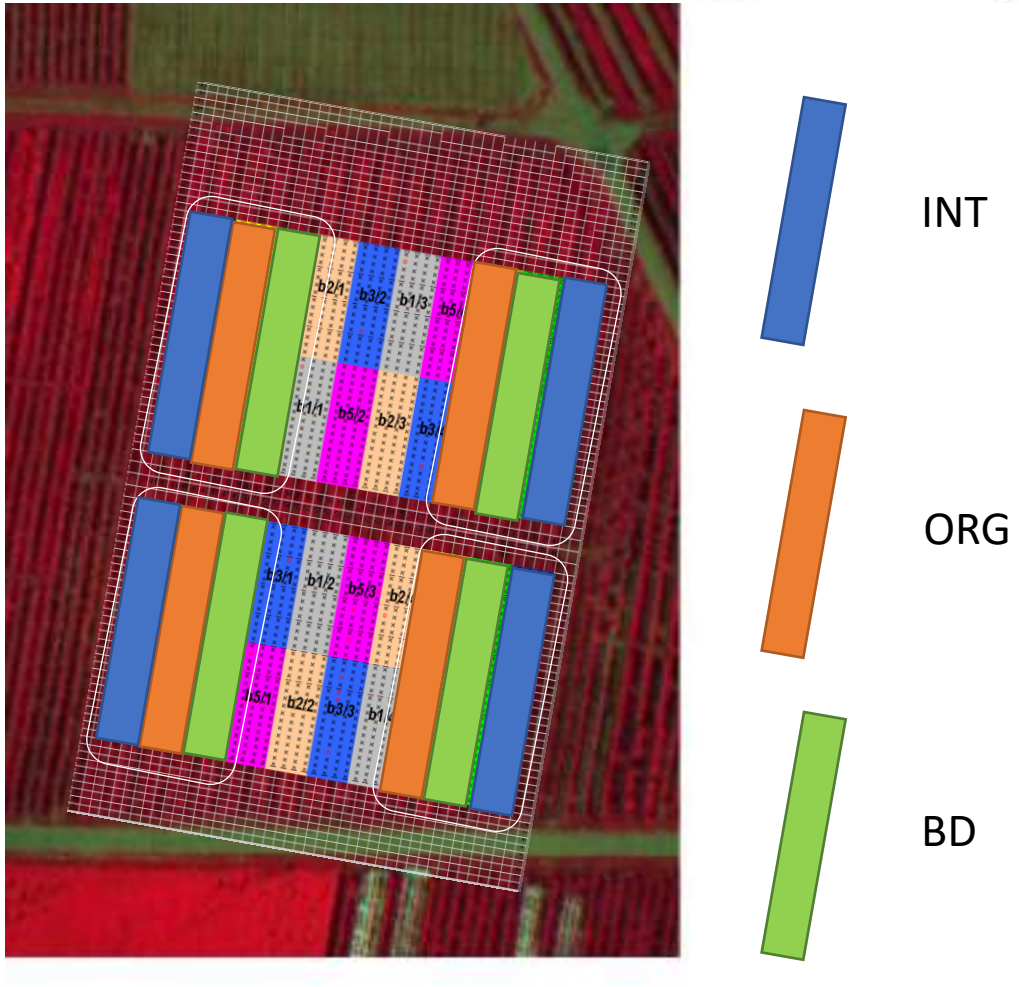
- **are an important parts of terroir**
- **directly affect soil fertility, nutrient supply, presence of antagonists to pathogenic micro- and macroorganisms**
- **influence vine health, growth, yield, and winegrape quality**

**Does organic and biodynamic viticulture have an impact on biodiversity ?**

# INBIODYN-trial Geisenheim since 2006

## Trial setup

- Geisenheim/ Rheingau (49°59´; 7°56´)
- Planted in 1991; ~ 1 ha
- Spacing of 2 m between rows
- Spacing of 1.2 m within rows
- VSP system
- Riesling Gm 198-30
- rootstocks: Börner, SO4 (randomly distributed)
- Soil: sandy/clayey loam
- 4 field replicates



# INBIODYN-trial Geisenheim

## Management systems:

- **Integrated (INT) according to good agricultural practice**
- **ORG according to Regulations (EC) No. 834/07 and 889/08 and ECOVIN guidelines**
- **BD according to Regulations (EC) No. 834/07 and 889/08 and demeter standards**

| | integrated | organic | biodynamic |
|---|---|---|---|
| cover crop | sward (every 2nd row cultivated) | multi-species mixture (every 2nd row cultivated) | |
| under-vine-management | herbicides | mechanically | |
| fertilization | green waste compost +<br><br>mineral fertilizers (according to $N_{min}$ analysis) | farmyard manure +<br><br>rolling or cultivation of cover crop | farmyard manure with biodynamic preparations (or cow pat pit preparation) +<br><br>rolling or cultivation of cover crop |
| plant protection | systemic fungicides<br>botryticides | copper (max. 3 kg/ha and year), wettable sulfur<br>plant resistance improvers | |
| | mating disruption method against grape berry moth | | |
| biodynamic preparations | - | - | horn manure, horn silica<br>compost preparations |

# Biodiversity in vineyards - inter row

- **Diverse cover crop mixtures for organic viticulture management systems**

# INBIODYN-trial Geisenheim

**Legumes: 74%**

*Trifolium alexandrinum*

*Trifolium incarnatum*

*Vicia sativa*

*Melilotus alba*

*Onobrychis viciifolia*

*Medicago lupulina*

*Medicago sativa*

*Lotus corniculatus*

**Crucifers: 1%**

*Raphanus sativa*

*Sinapis alba*

**Cover crop mixture for organic viticulture** (by M.Wolff)

**Herbs: 25%**

*Phacelia tanacetifolia*

*Coriandrum sativum*

*Centaurea jacea*

*Borago officinalis*

*Sanguisorba minor*

*Achillea millefolium*

*Daucus carota*

*Petroselinum sativum*

*Fagopyrum esculentum*

*Calendula officinalis,*

*Malva sylvestris*

*Anethum graveolens*

*Carum carvi*

*Cichoricum intybus*

*Plantago lanceolata*

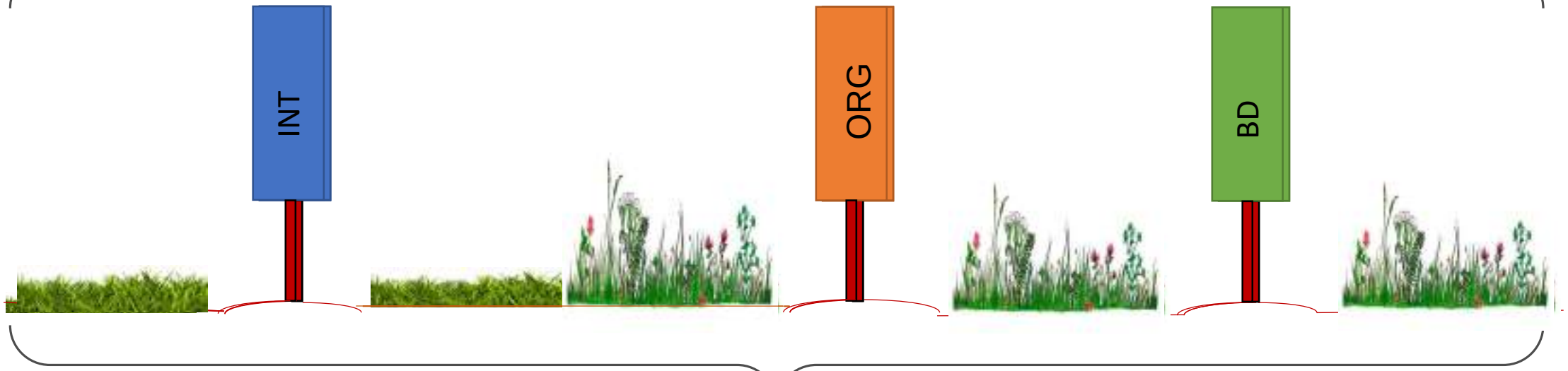
*Anthoxanthum vulneraria*

# INBIODYN-trial Geisenheim

## Assessment of soil microbial and arthropod biodiversity

**Biodiversity of arthropods in cover crop and canopy** (Freund 2008, Harnecker, Heim 2020)

Arthropod community (flying/soil living) + associated fungi (Agerbo Rasmussen et al. 2020)



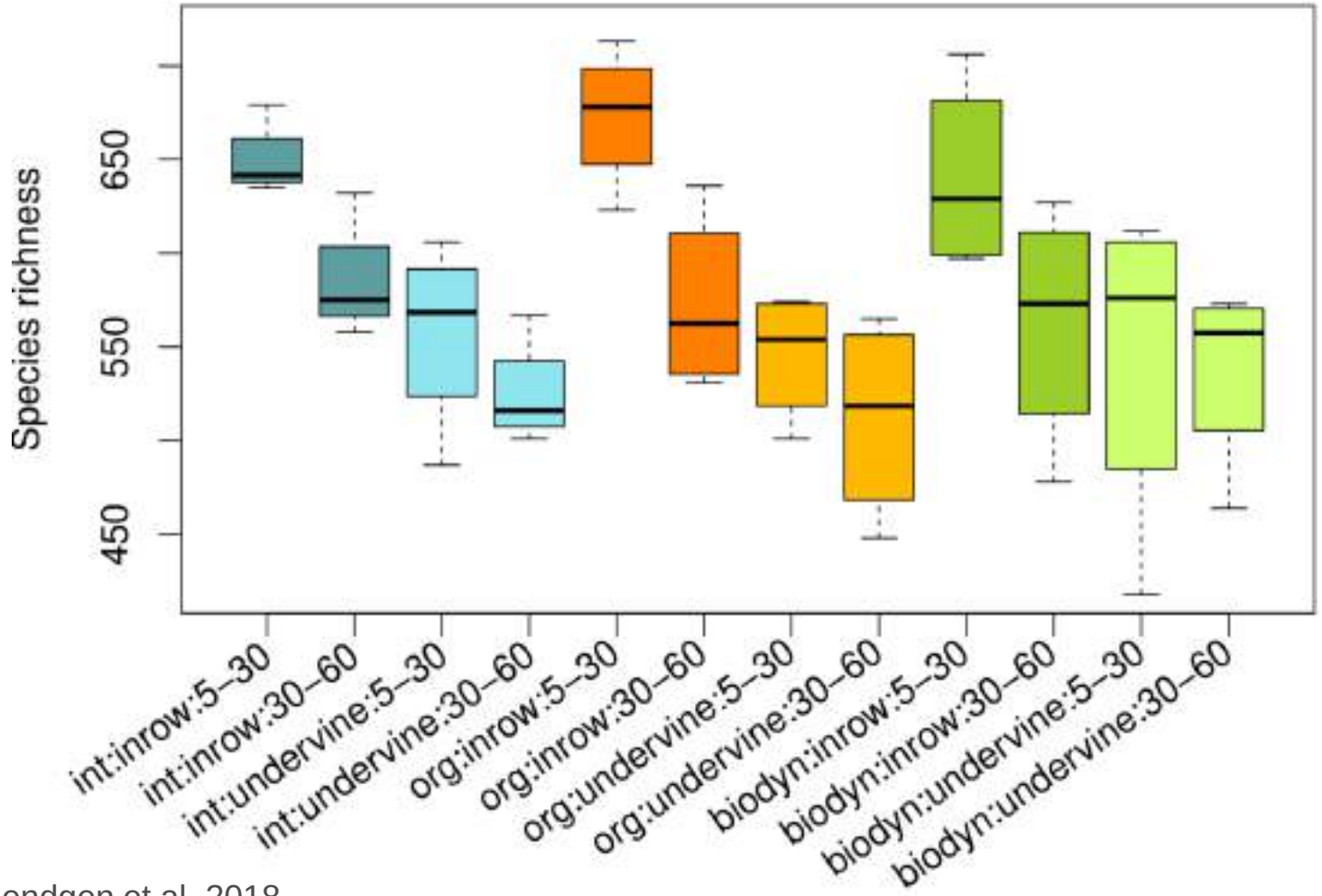

**Earth worms in soil**
(Schmieg 2007, Meissner 2015)

**Fungal/ bacterial community in soil**
(Hendgen et al. 2018)

Microbial biomass in soil (Di Giacinto et al. 2020)

# INBIODYN trial - Fungal community in soil

**Species richness of fungi in soil in August 2015 - position and depth (in row and under vine)**



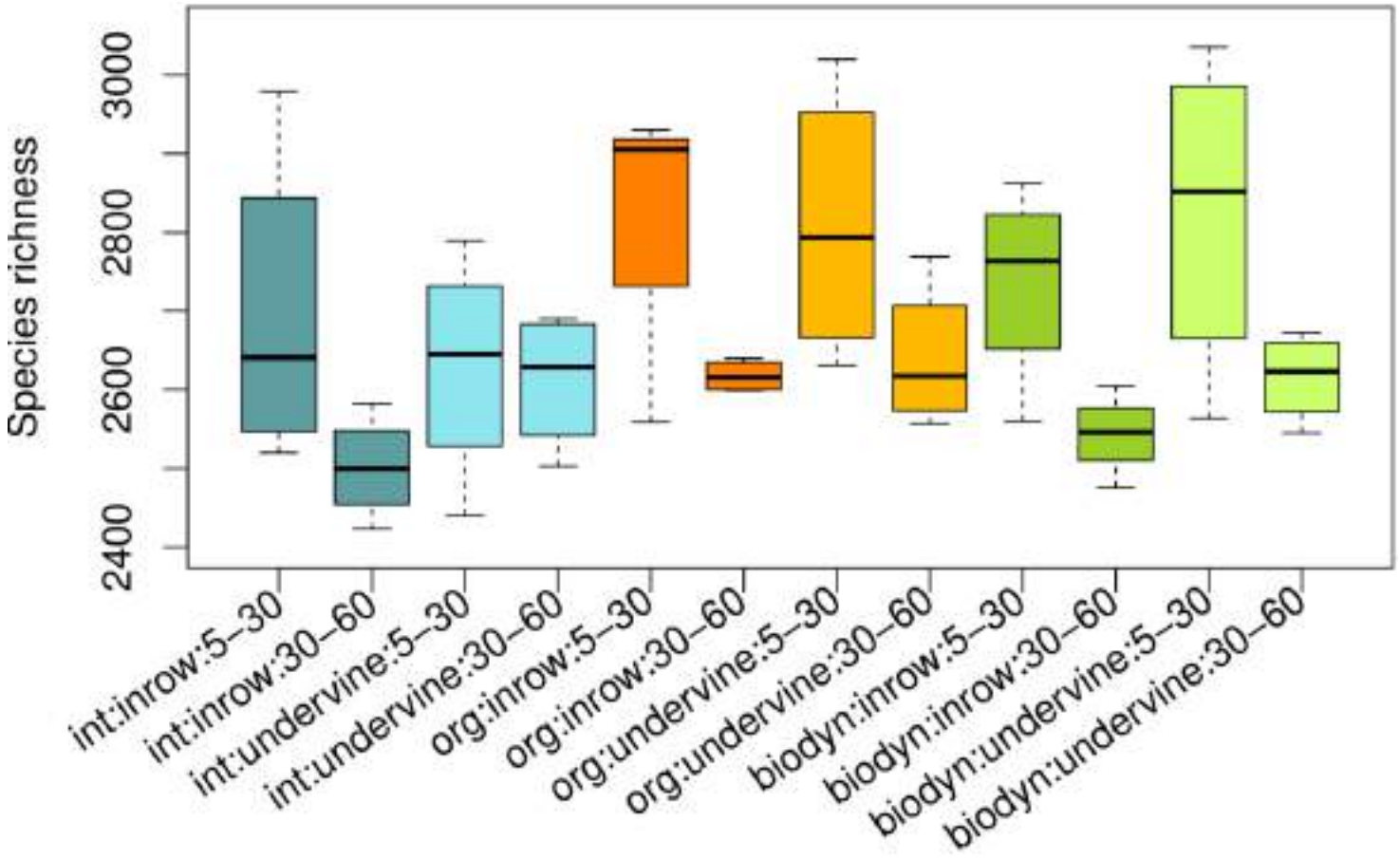

Hendgen et al. 2018

## Results

- **management system**: no difference
- **position**: inrow significantly richer than undervine
- **depth**: topsoil richer than subsoil

# INBIODYN trial – Bacterial community in soil

**Species richness of bacteria in soil in August 2015 - position and depth (in row and under vine)**




## Results

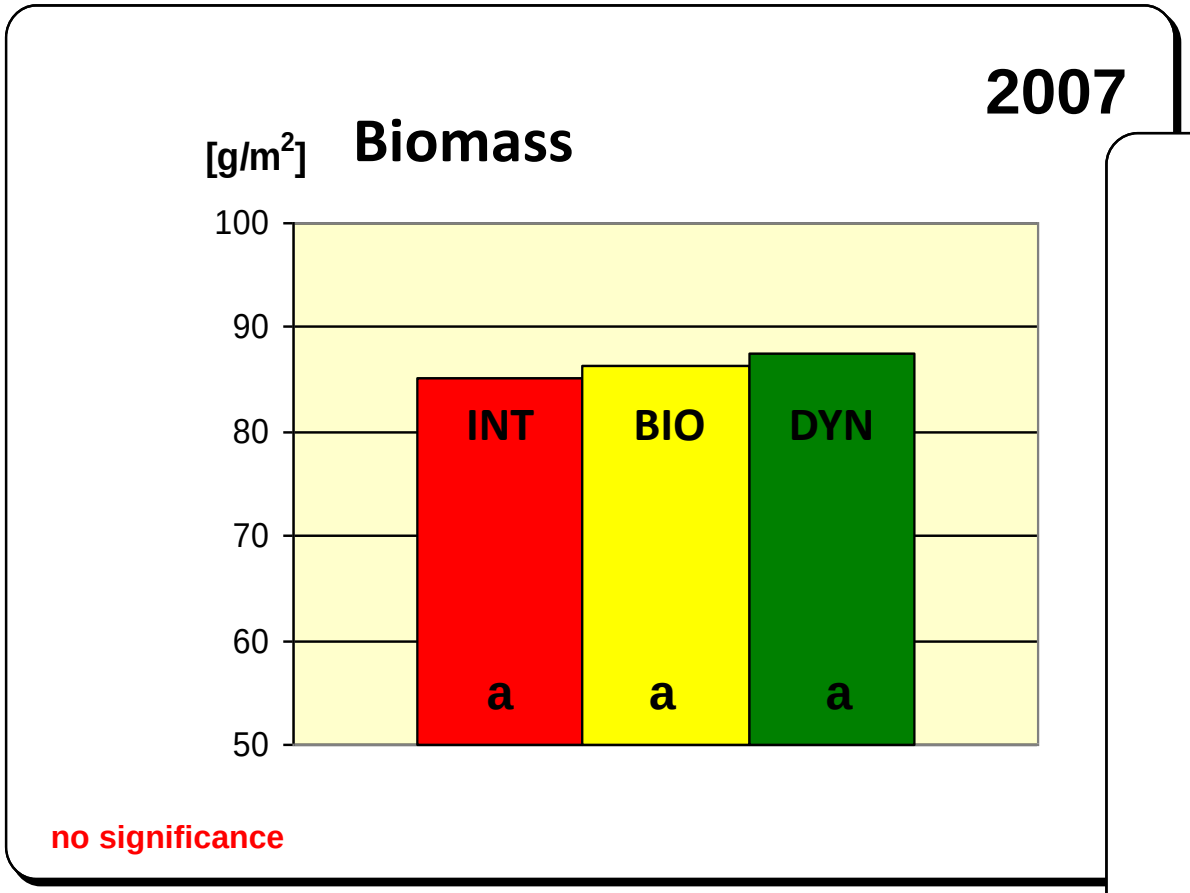
- **management system**:
  org and biodynamic have more species compared to integrated
- **position**:
  no differences
- **depth**:
  topsoil in all systems has more species compared to subsoil

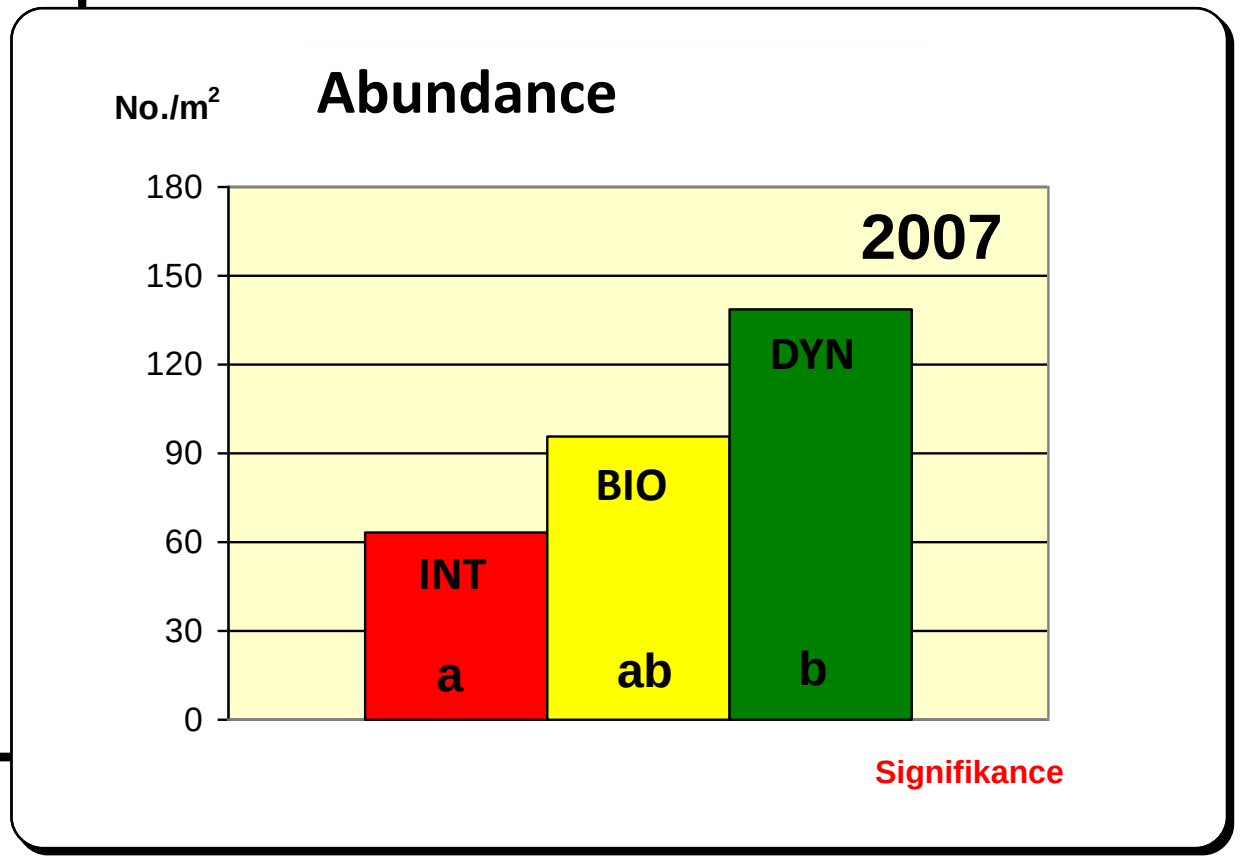
Hendgen et al. 2018

# INBIODYN trial – Earthworms in soil

Schmieg 2007, Meissner 2015

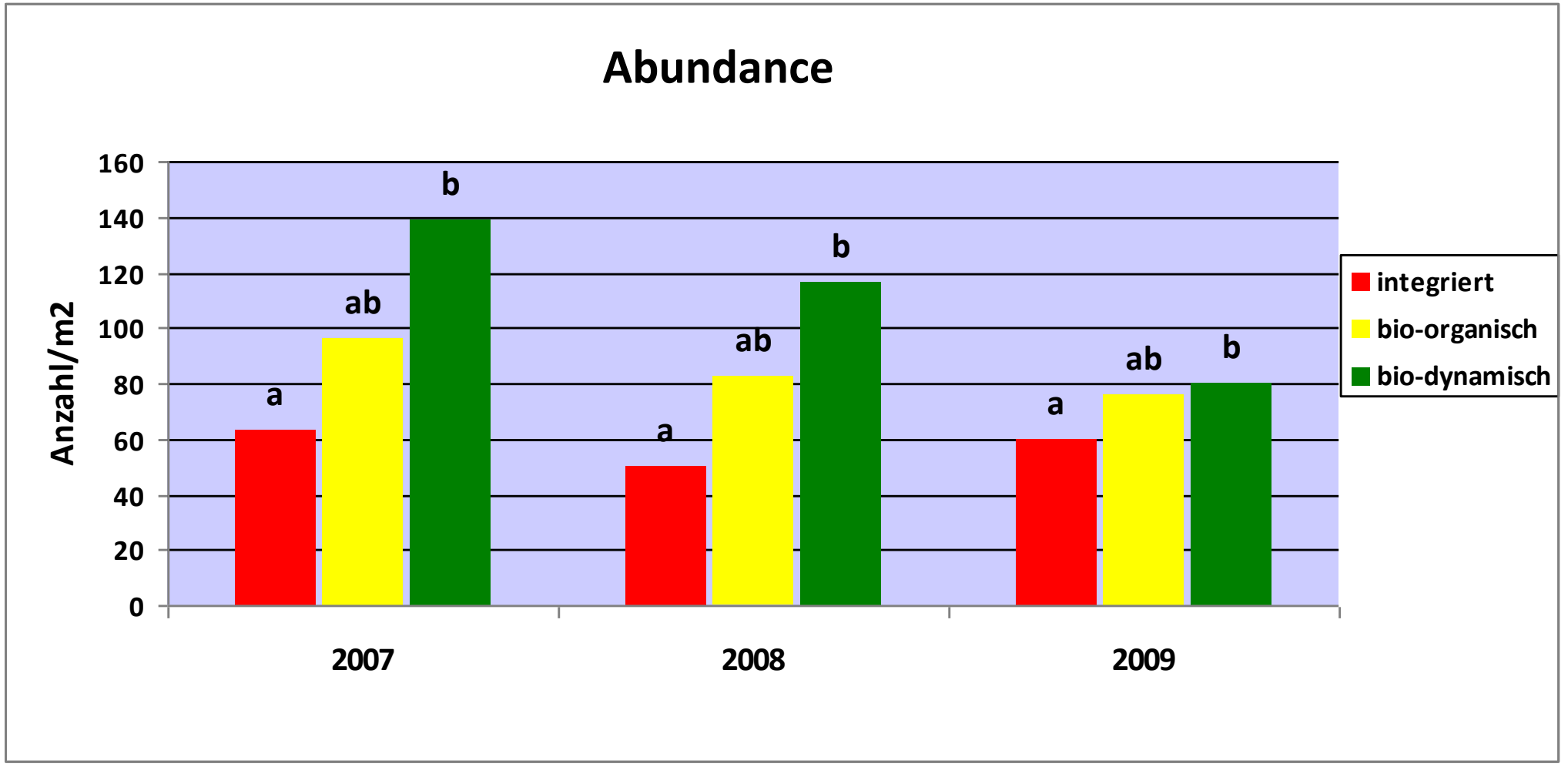
# INBIODYN trial – Earthworms in soil




Julia Schmieg 2007

# INBIODYN trial – Earthworms in soil

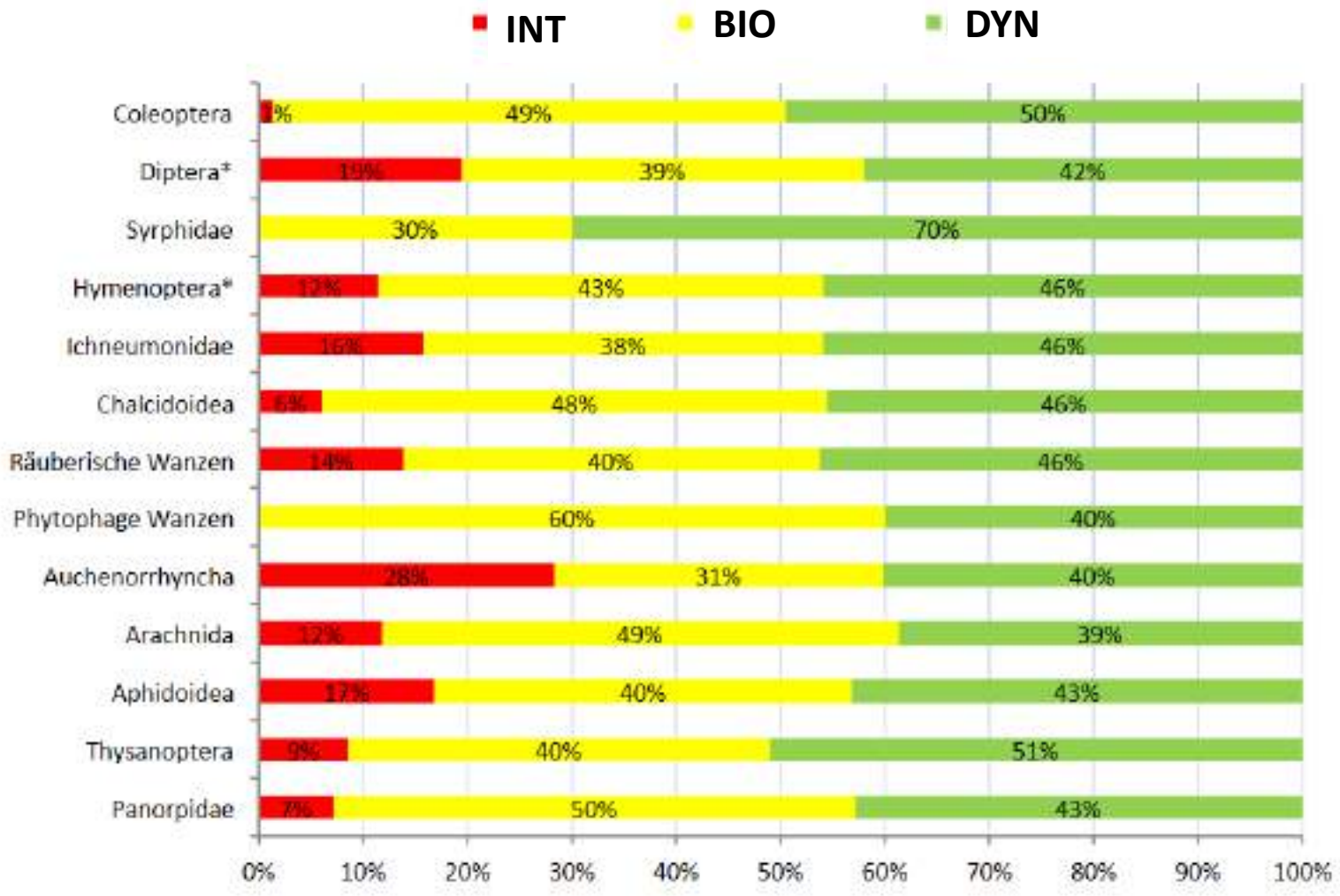



Meissner 2015

# Biodiversity of arthropods, in the cover crop and in the canopy in 2008

Pictures: Kauer, Meissner, Freund 2008

# INBIODYN trial – arthropods in cover crop

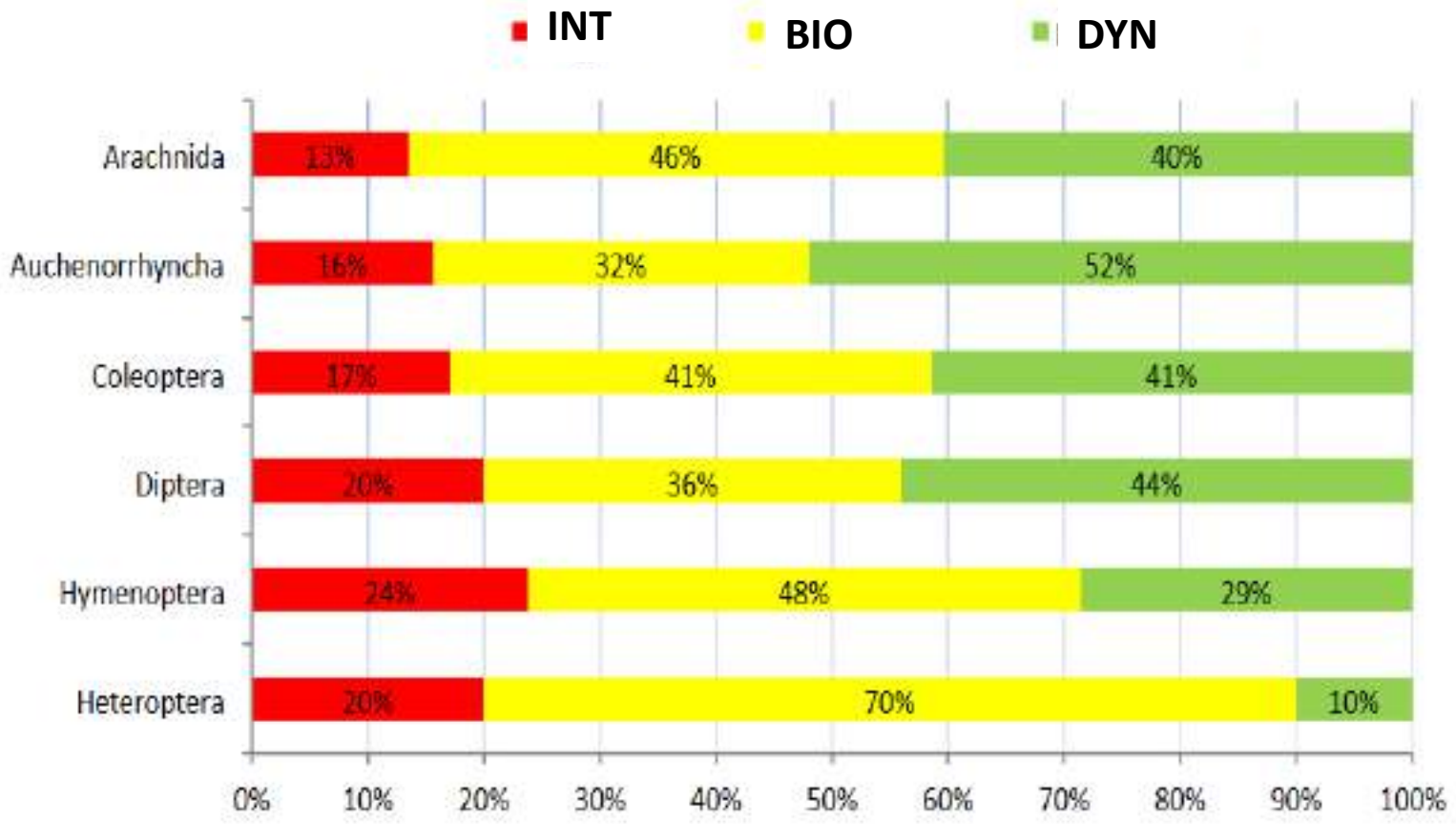



## Result

- **Arthropod abundance much higher in cover crop of organic viticulture systems in the 3rd year of conversion**

Freund 2008

# INBIODYN trial – arthropods in canopy

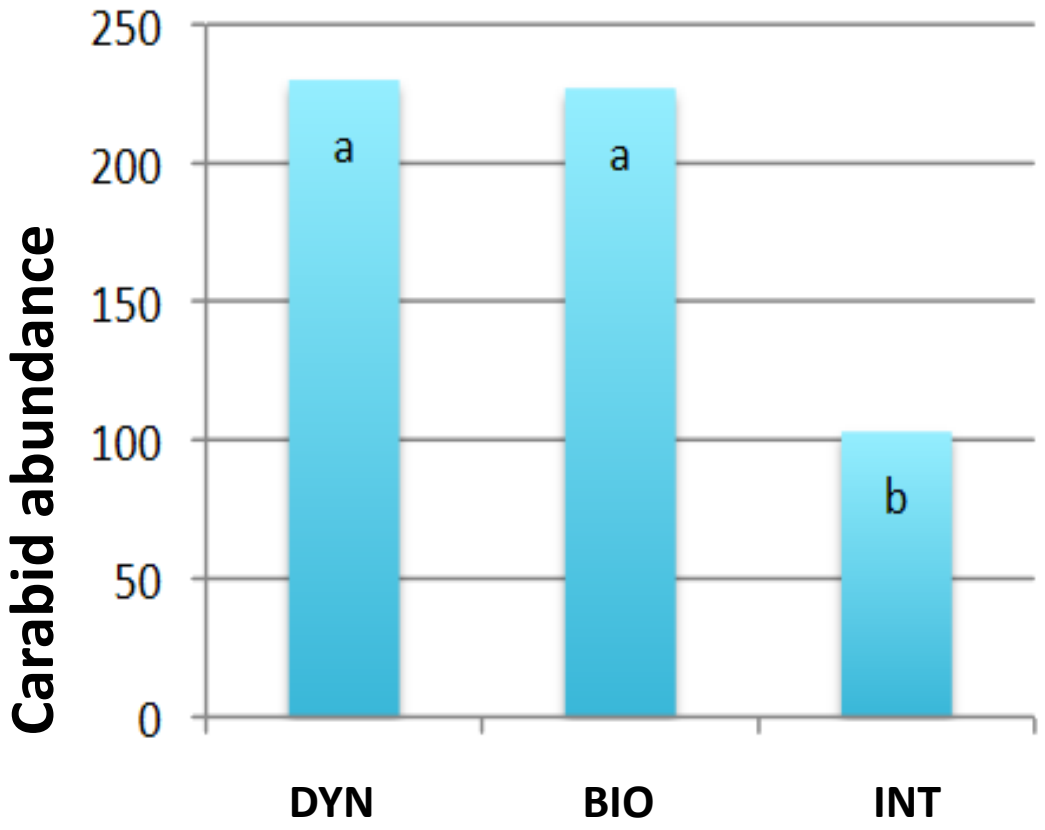



## Result

- **Arthropod abundance much higher in canopies of organic viticulture systems in the 3rd year of conversion**

Freund 2008

# INBIODYN trial – carabids on soil




## Result:

- **Abundance of Carabids higher in organic viticulture systems compared to INT viticulture**
- **Biodiversity of carabis similar in all treatments**

# Biodiversity in vineyards …

- **can be enhanced by organic and biodynamic viticulture management systems**
- **can ensure vital and productive agroecosystems**
- **buffers negative impacts, especially under changing climatic and environmental conditions**

# Literature cited


- Agerbo-Rasmussen J, Nielsen M, Mak SST, Döring J, Klincke F, Gopalakrishnan S, Dunn RR, Kauer R, Gilbert MTP. eDNA-based biomonitoring at an experimental German vineyard to characterize how management regimes shape ecosystem diversity. Environmental DNA (2020) https://doi.org/10.1002/edn3.131
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