How do yields from organic systems actually compare to conventional practices?

Lauren Ponisio
Water & soil
Climate Change

Foley et al. (2011)
Biodiversity loss

Foley et al. (2011)
Not nourishing people

1 billion hungry

1 billion overweight
30-40% of production is wasted
Industrial agriculture cannot “feed the world”
Plot | Field | Landscape
Polyculture/inter-cropping
Spatial Diversification

Polyculture/inter-cropping
Polyculture/inter-cropping

Nutrients, Water, Soil, Pest control, Pollination

Agro-biodiversity

Kremen and Miles (2012)
Polyculture/inter-cropping

Nutrients
Water
Soil
Pest control
Pollination

Agro-biodiversity
Polyculture/inter-cropping
Crop rotation/cover crop

Nutrients Water Soil Pest control Pollination

Agro-biodiversity

Kremen and Miles (2012)
Temporal Diversification
Polyculture/inter-cropping
Crop rotation/cover crop

Nutrients
Water
Soil
Pest control
Pollination

Agro-biodiversity

Kremen and Miles (2012)
1 billion hungry

1 billion overweight
Altieri and Toledo (2011)
100% ORGANIC
NO HARM TO NATURE
100% ORGANIC
ENVIRONMENT FRIENDLY
NO HARM TO NATURE

VS.

Aircraft spraying a field.
Spatial Diversification

Temporal Diversification

vs.

100% ORGANIC

NO HARM TO NATURE
Meta-analysis
Meta-analysis
Meta-analysis

115 studies,
1071 yield comparisons

38 countries
52 crop species
35 years
Meta-analysis

Meta-analytic model
Overall yield ratio estimate

Organic yield / Conventional yield

Ponisio et al. 2014
Overall yield ratio estimate

\[ \sim 19\% \pm 4\% \]

Organic yield / Conventional yield

Ponisio et al. 2014
Spatial Diversification
Spatial Diversification

Cover crop organic (11,104)
No cover cropping (79,772)
Both cover crop (17,94)
Similar rotations (54,670)
No rotations (36,178)
More rotations in organic (14,113)
Organic polyculture only (17,173)
Polyculture (18,367)
Monoculture (77,449)
Overall (115,1071)

Organic yield / Conventional yield

~9% +/- 4%

Overall

Organic Poly/Conv Mono

Ponisio et al. 2014
Temporal Diversification
Temporal Diversification

Organic yield / Conventional yield

Overall
No rotations
Similar rotations
More rotations organic

Cover crop organic (11,104)
No cover cropping (79,772)
Both cover crop (17,94)
Similar rotations (54,670)
No rotations (36,178)
More rotations in organic (14,113)
Organic polyculture only (17,173)
Polyculture (18,367)
Monoculture (77,449)
Overall (115,1071)

Ponisio et al. 2014
Temporal Diversification

Organic yield / Conventional yield

Overall
No rotations
Similar rotations
More rotations organic

Ponisio et al. 2014
Temporal Diversification

Organic yield / Conventional yield

Overall

More rotations
organic

~8% +/- 5%

Ponisio et al. 2014
Temporal Diversification
Temporal Diversification

0.5 0.6 0.7 0.8 0.9 1.0 1.1

Organic yield / Conventional yield

Cover crop organic (11,104)
No cover cropping (79,772)
Both cover crop (17,94)
Similar rotations (54,670)
No rotations (36,178)
More rotations in organic (14,113)
Organic polyculture only (17,173)
Polyculture (18,367)
Monoculture (77,449)
Overall (115,1071)

Ponisio et al. 2014
**Temporal Diversification**

- **Overall**
- **Both cover crop**
- **Neither cover crop**
- **Organic cover crop**

**Organic yield / Conventional yield**

Ponisio et al. 2014
Temporal Diversification

~6% +/- 3%

Organic yield / Conventional yield

Ponisio et al. 2014
Continuous corn v. corn-soybean rotation
Caveats to these estimates

\[ \sim 19\% \pm 4\% \]

Organic yield / Conventional yield
Caveats to these estimates
Organic yield / Conventional yield
Caveats to these estimates

R&D
Caveats to these estimates

R&D

USDA

98%

Organic

2%

Conventional

Carlisle and Miles (2013)
Caveats to these estimates

R&D

USDA

Organic

Conventional

Carlisle and Miles (2013)
Caveats to these estimates

USDA: 98%

Organic: 2%

Conventional

R&D

Carlisle and Miles (2013)
Caveats to these estimates

Carlisle and Miles (2013)
Temporal Diversification

Organic yield / Conventional yield

Temporal Diversification

Overall

No rotations

Similar rotations

More rotations

organic

Spatial Diversification

Organic yield / Conventional yield

Spatial Diversification

Overall

Mono/Mono

Poly/Poly

Organic Poly/
Converted Mono

Mono/Mono

Poly/Poly

Organic Poly/
Converted Mono
additional slides
Caveats to these estimates
Caveats to these estimates
Caveats to these estimates
Caveats to these estimates

Decade of publication

Proportion in data

- Cereals
- Fruits and nuts
- Vegetables
- Oil crops
- Roots & tubers
Caveats to these estimates

Decade of publication

Proportion in data

Organic yield/conventional yield (log)

Year of publication

Cereals
Fruits and nuts
Vegetables
Oil crops
Roots & tubers

Caveats to these estimates
Caveats to these estimates

Proportion in data

Decade of publication

Organic yield/conventional yield (log)

Year of publication

- Cereals
- Fruits and nuts
- Vegetables
- Oil crops
- Roots & tubers
Caveats to these estimates