

Food production per land area

Does organic agriculture require more land to feed people?

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1

At first glance, yield gaps between organic and conventional agriculture imply a higher land use for food production from organic agriculture.

Organic farmers have been criticised for using more land to produce food, but is this backed up by evidence?

2

Crop yield measured as delivered calories¹ rather than tonnes per hectare reveals unexpected differences in food production due to different crop uses (such as food, fodder or biofuel).

Since the organic and conventional sectors cater to different markets, it is likely that they also have different crop uses.

3

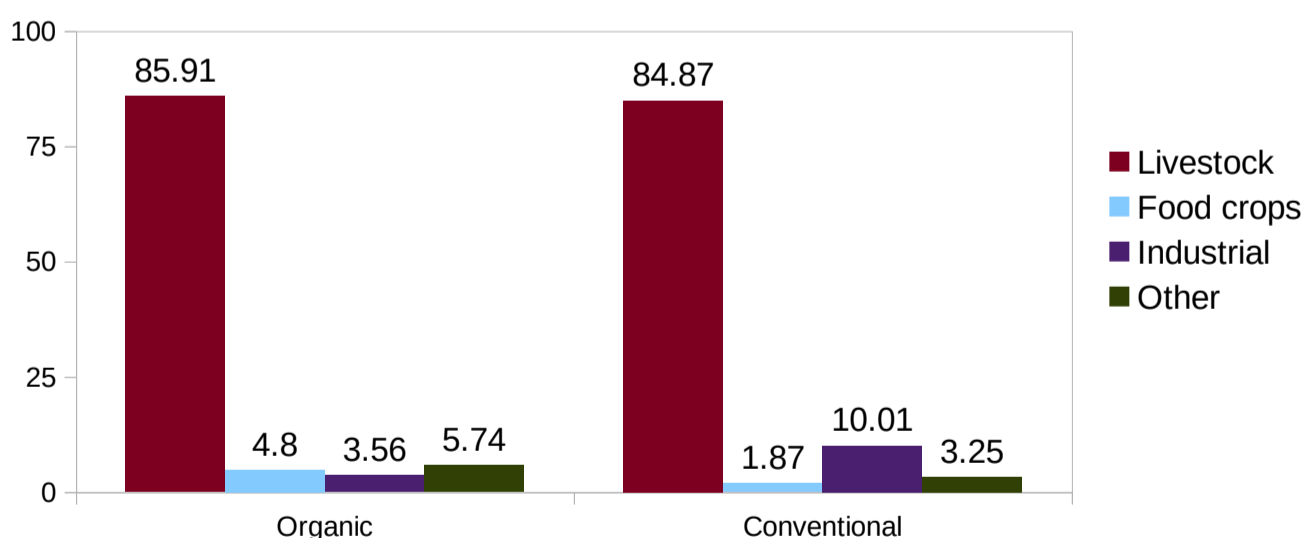
I used Danish government statistics on farm land use² and production³, combined with yield gap estimates from the literature⁴, to estimate food production from organic and conventional farmland in Denmark.

I then quantified these production estimates as calories provided⁵ per hectare.

4

Agriculture in Denmark is largely devoted to the livestock industry. The organic and conventional sectors differ most notably in their shares of edible and industrial crops.

Land use profiles: % share of land use



Organic farms produce **2.855** kCals per ha, while conventional farms produce **2.884** kCals per ha. This difference (**1.02%**) is much less than the yield gaps would imply, and is smaller than the uncertainty introduced by different estimates⁶ of the yield gaps.

5

Taken as a whole, the organic sector in Denmark produces a similar amount of food per land area as the conventional agriculture sector.

I suggest that the effects of crop uses override the effect of the yield gap in estimates of food production. Farm yields alone do not give a meaningful indication of the ability of agricultural systems to feed people.

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1. Cassidy ES, West PC, Gerber JS & Foley JA 2013, 'Redefining agricultural yields: from tonnes to people nourished per hectare', *Environmental Research Letters* 8.

2. The Danish Agricultural Agency 2018, 'Statistics on organic agricultural holdings' lbst.dk

3. Statistics Denmark 2019, statbank.dk

4. Seufert V, Ramankutty N & Foley JA 2012, 'Comparing the yields of organic and conventional agriculture', *Nature* 485.

5. Technical University of Denmark 2019, *Frida Food Database*, <https://frida.fooddata.dk>

6. Ponisio LC, M'Gonigle LK, Mace KC, Palomino J, de Valpine P & Kremen, C 2015, 'Diversification practices reduce organic to conventional crop yield', *Proceedings of the Royal Society B* 282.