BUNDESANSTALT für Agrarwirtschaft
FEDERAL INSTITUTE of Agricultural Economics

MINISTERIUM FÜR EIN LEBENSWERTES ÖSTERREICH

Usage of FADN data for organic yield estimations

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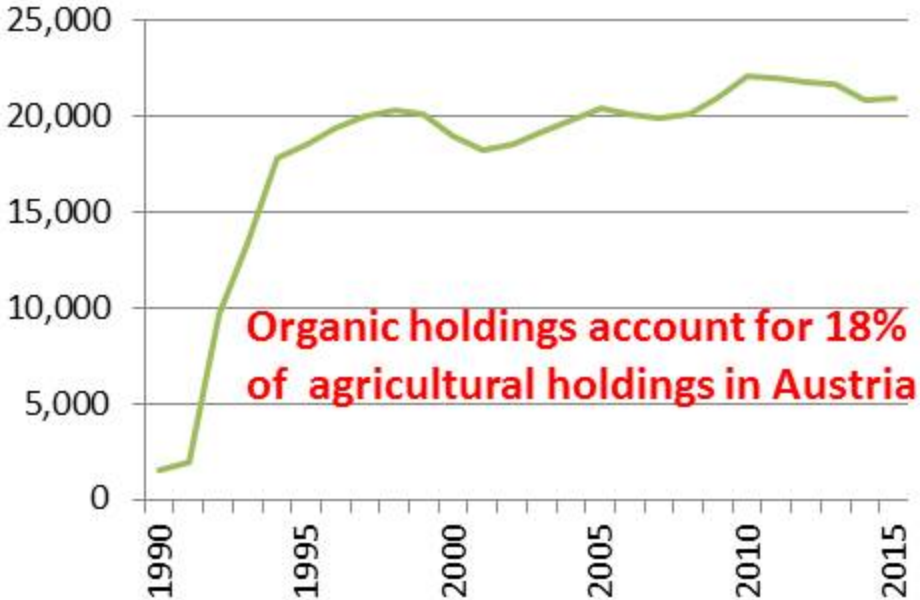
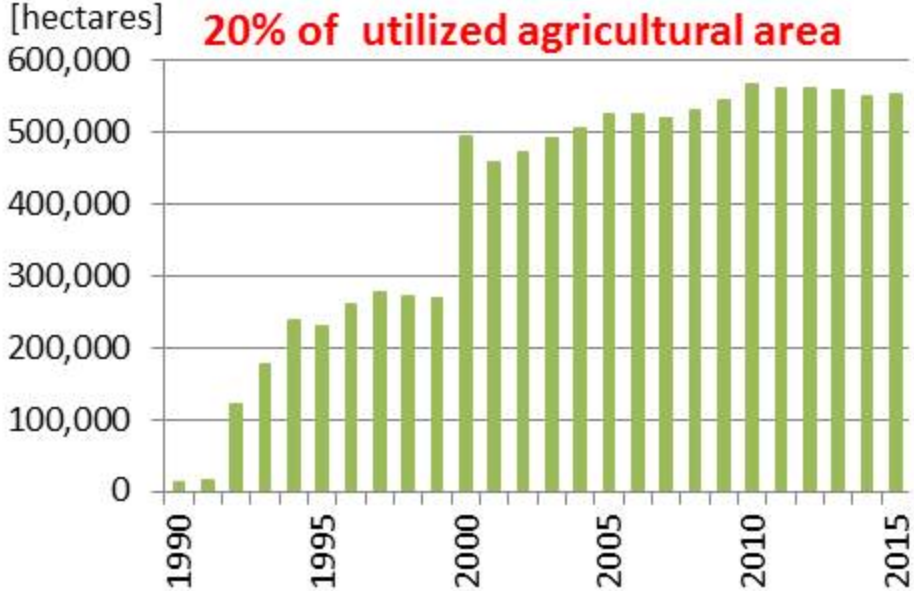
Organic farming in Austria

Number of organic holdings

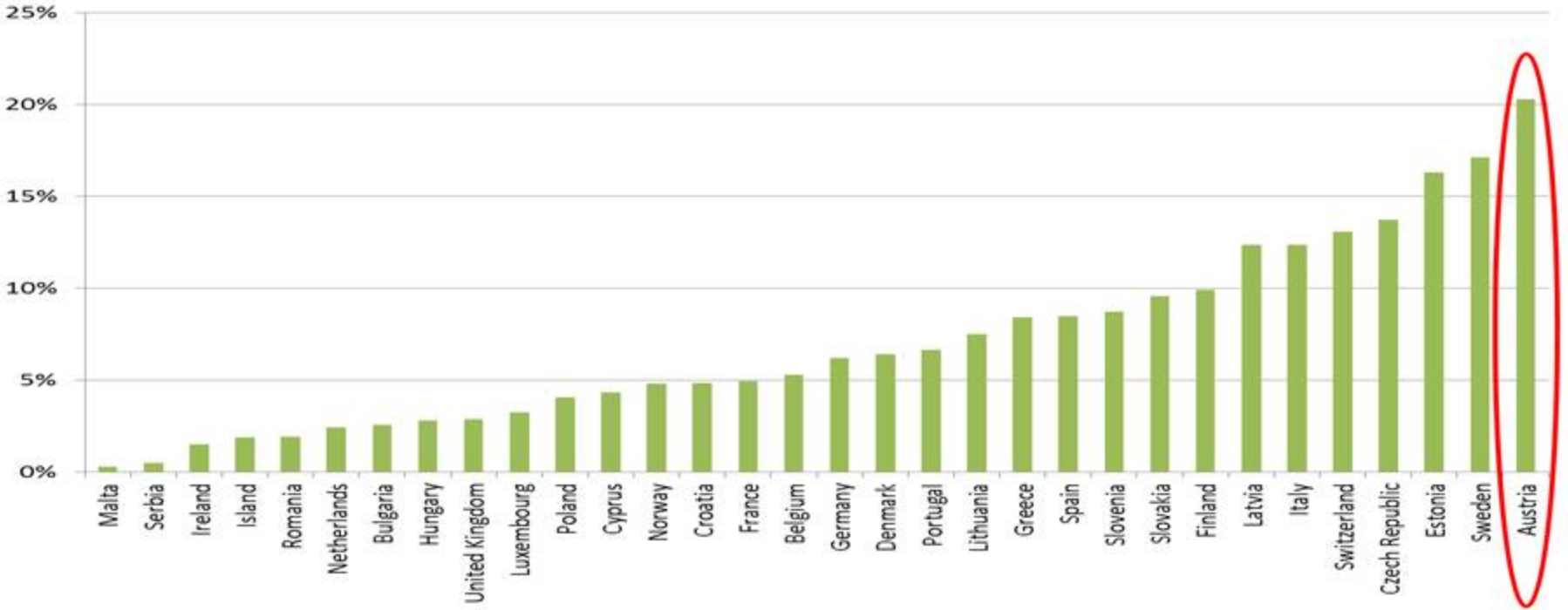


Areas under organic farming*



Source: AWI (2016)

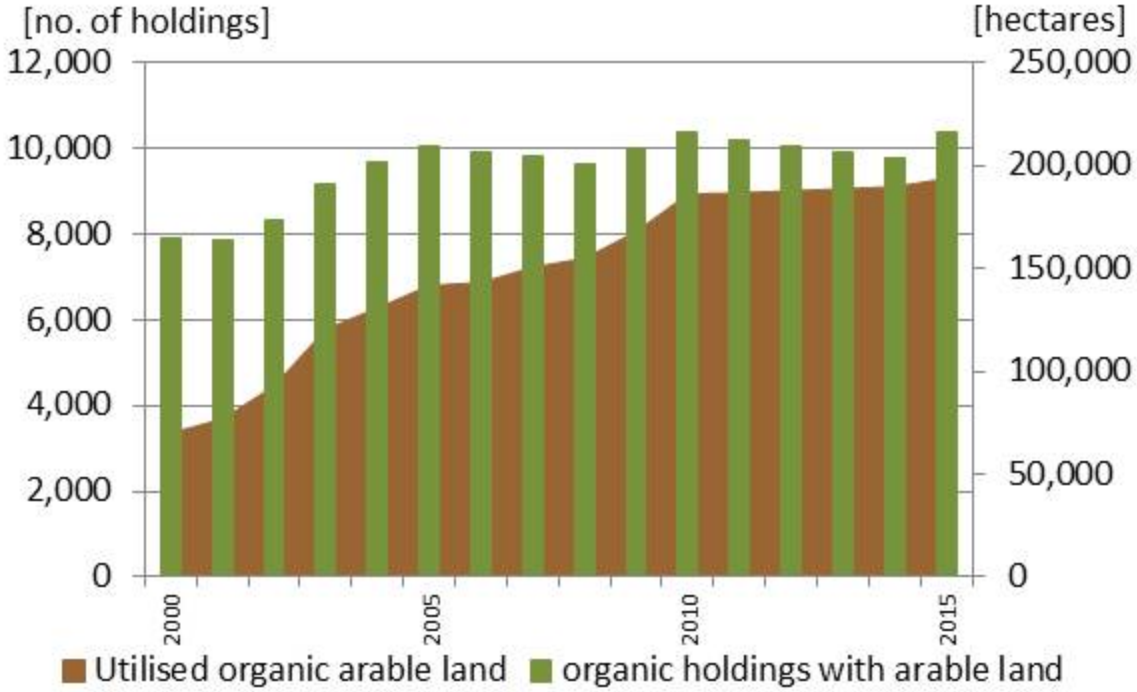
Share of utilised agricultural area under organic farming (in 2015, EU 28)



Source: Eurostat (2016)

Organic arable land

- There was a vast expansion of organic arable land, which almost tripled since the year 2000
- Increased attention is laid on the productivity of organic crop production



Source: AWI and Federal Authorities (2016)

Crop yields of organic farming

Organic agriculture (may) have lower crop yields

→ Demand for more land to produce the same amount of food

What is the relative yield performance?

- International research (meta-analysis)
  - Seufert et al. (2012): organic crop yields ~25% lower
  - De ponti et al. (2012): organic crop yields ~20% lower

Why to know organic crop yields?

- Politicians/ecologists/economists/extension service
  - Calculation of support provided for organic farms
  - Economic calculations (gross margin organic vs. conventional)
  - Calculation of ecological impacts per produced quantity
  - Self sufficiency rates of primary production (dependency on imports)
- Farmers need empiric evidence for their individual economic decisions

Crop yield data – present sources

Representative crop yield data is estimated on an annual basis.

- Statistics Austria (Federal Institute for statistics Austria)
  - Annual crop yield estimations (harvest declarations) based on voluntary observers
- AMA (Austrian Market Organisation)
  - Annual crop yield data based on weighted crop yields (Agricultural chambers)
  - There will be annual organic crop yield statistics from 2016 on!

Data is not collected separately (organic and conventional crop yields)

Organic farming statistics are limited to area under organic farming and number of holdings

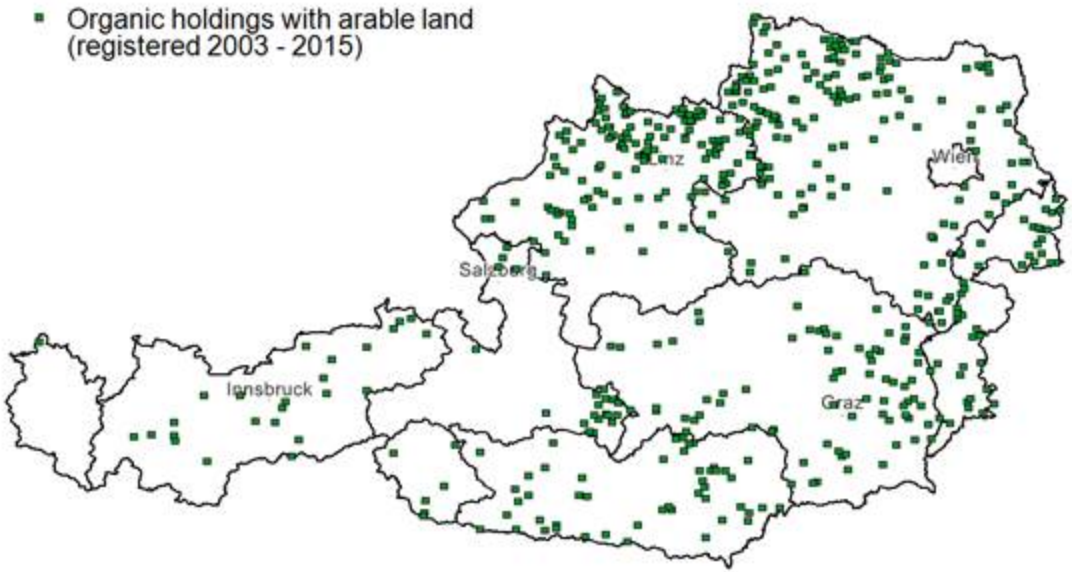
FADN data base

- In the framework of the FADN survey, crop yield data of conventional and organic farming systems is collected
- So far no regular use of this crop yield source
- Sporadic use for extrapolations

FADN data – arable organic and conv. farms

Number of organic holdings

Year	with arable land	with arable land without livestock	with arable land and livestock
2003	265	37	228
2004	281	44	237
2005	299	61	238
2006	296	55	241
2007	287	54	233
2008	285	52	233
2009	293	53	240
2010	297	62	235
2011	309	68	241
2012	319	81	238
2013	322	87	235
2014	320	86	234
2015	304	88	216



Source: AWI, 2016

Method (1)

- Crop yield averages are weighted on the level of
  - major agricultural production areas and
  - dry/humid agricultural areas.
- Organic holdings are slightly overrepresented in the FADN survey
- IACS data (acreage) was used to extrapolate the weighted averages of organic crop yields per crop type on a regional level*

- $CY_W = \frac{\sum_{i,cp} cy_i * ha_i}{\sum_{i,cp} ha_i}$

cy…crop yield

cp.. crop type

ha…hectares

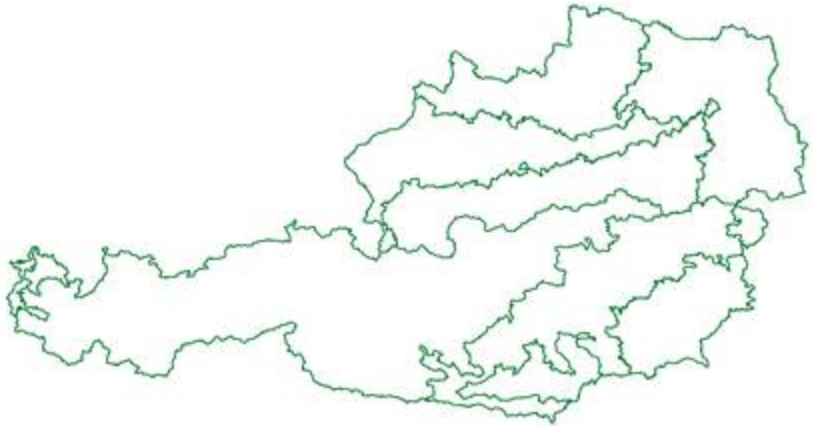
Cyw = Weighted average crop yield per crop type and region*

*Region/ Regional level = Major production area and dry/humid agricultural area, respectively

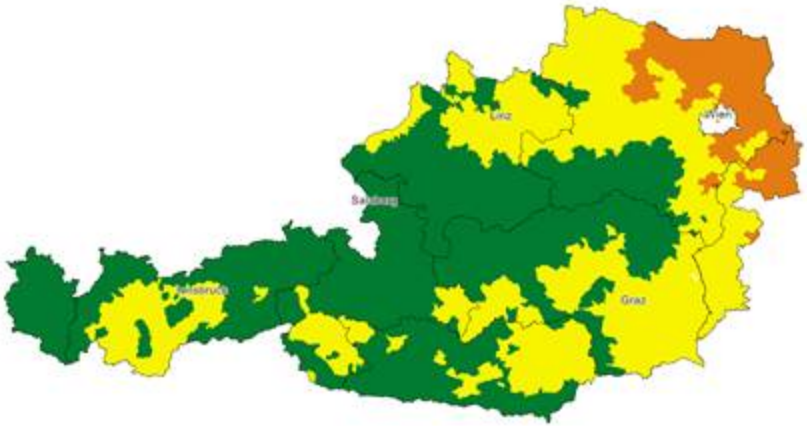
Method (2)

Two independent analysis

Major agricultural production areas



Dry/ humid agricultural areas



Major agricultural production areas

8 major agricultural production areas

Agricultural production areas are characterized by different elevations, slope gradients as well as key characteristics of agricultural holdings

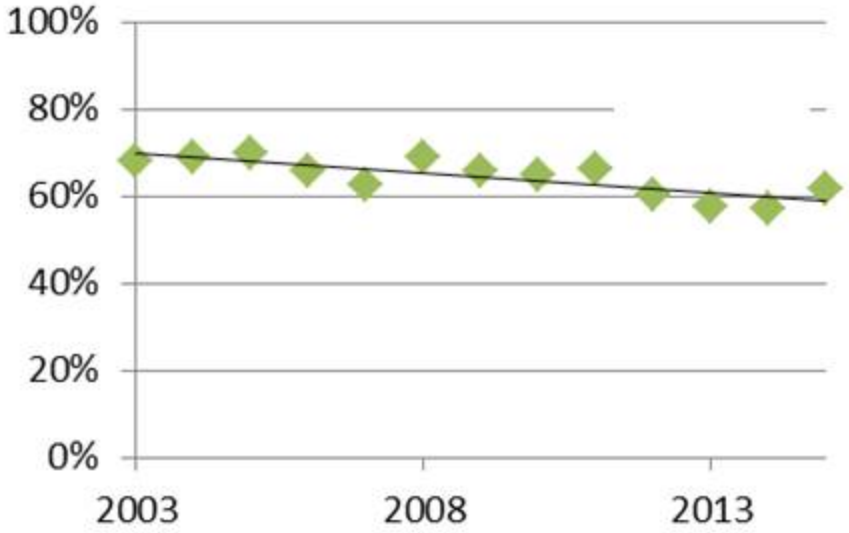
e.g. size and production activity

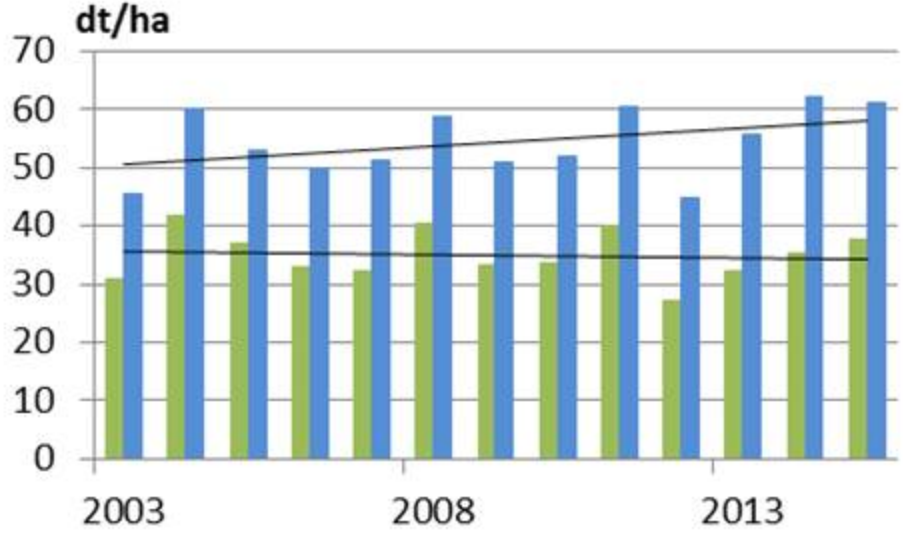
Relative organic crop yields per hectare compared to conventional crop yields

	Relative yield (%)	Standard deviation (±%)	n^o	n^c	area* (ha)
Cereals					
Common Wheat	64.7	33.8	1,333	10,271	26,278
Rye	61.3	47.0	1,315	2,722	12,530
Winter barley	61.2	38.2	496	7,434	4,317
Summer barley	66.1	46.2	759	5,952	5,693
Oat	66.6	48.7	983	2,865	6,742
Triticale	69.2	36.0	1,309	4,564	9,039
Corn	64.7	41.3	511	6,695	8,796
Spelt	63.2	41.6	826	225	6,577
Root crops					
Potatoes	52.2	50.9	1,555	4,226	2,309
Sugar beets**	71.0	-	-	-	638
Oilseed and protein crops					
Oil pumpkin	80.5	78.0	348	1,965	2,834
Field peas	58.1	57.5	493	1,882	5,750
Soybean	81.5	42.9	215	1,772	5,090

n^o = number of observations on organic farms; n^c = number of observations on conventional farms; *mean annual crop area under organic farming 2003-2014;**yield data of sugar beets only available from 2008-2015

Relative organic crop yields – Common Wheat



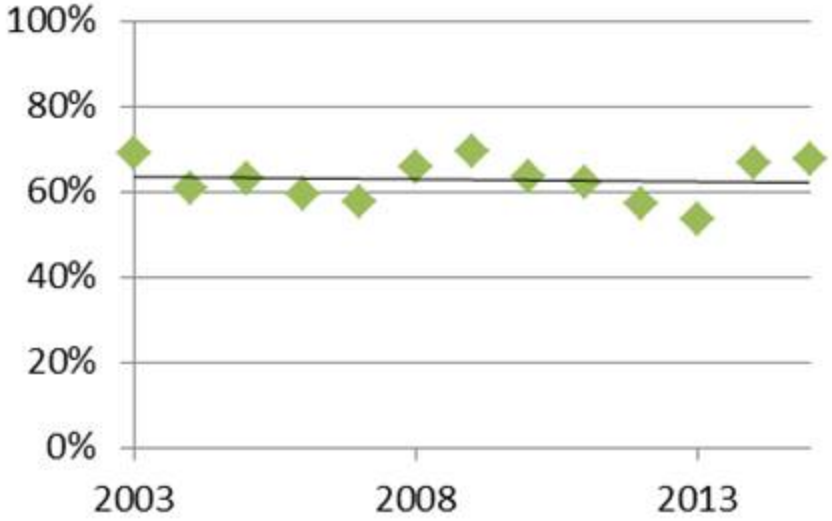


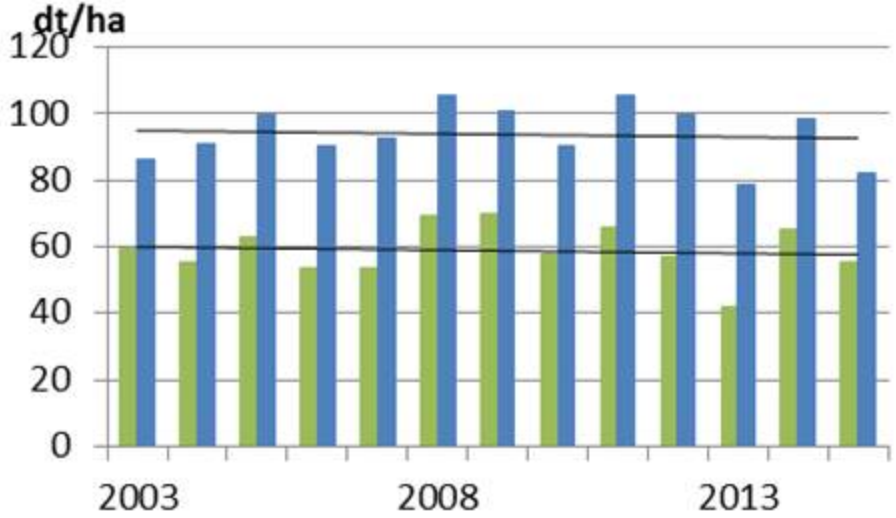
Number of documented crop yields

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Org	83	88	106	100	108	100	97	103	109	109	113	107	110
Conv	854	878	883	836	813	818	784	763	748	721	714	719	740

Source: AWI, 2016

Relative organic crop yields - Corn

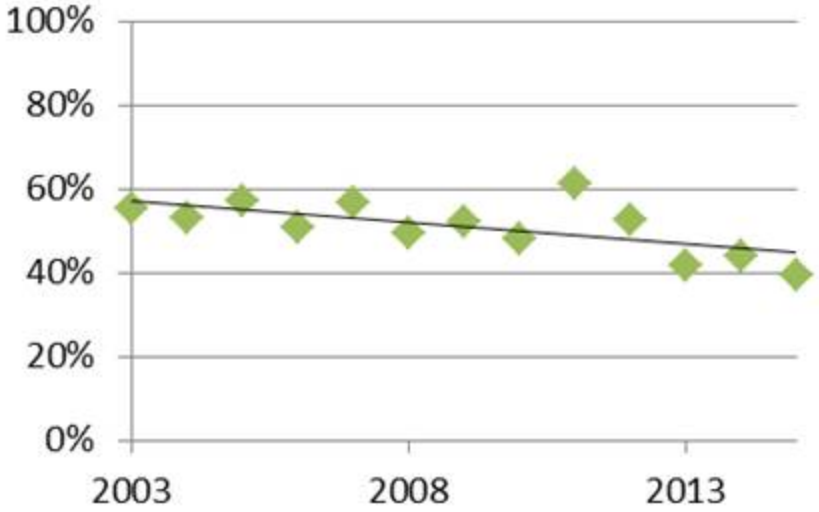


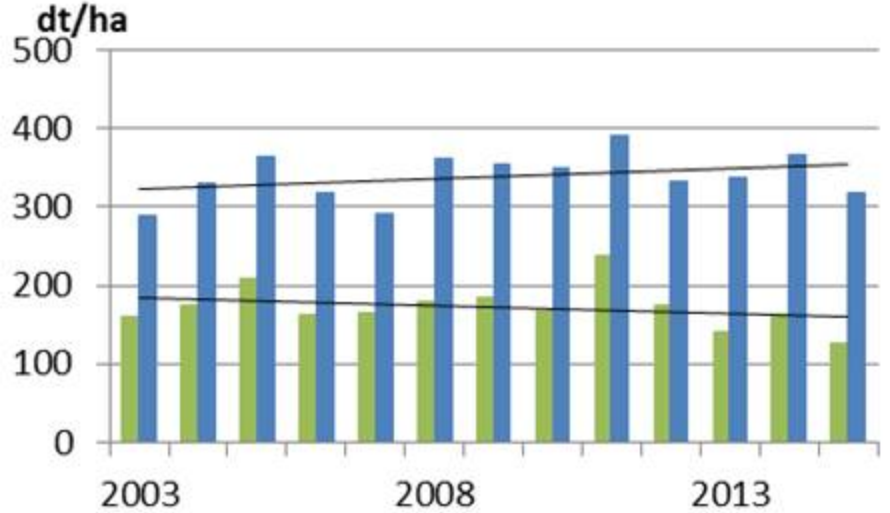


Number of documented crop yields

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Org	33	29	33	24	33	45	40	38	44	50	43	52	47
Conv	560	541	520	461	522	541	481	477	533	567	461	530	501

Relative organic crop yields - potatoes



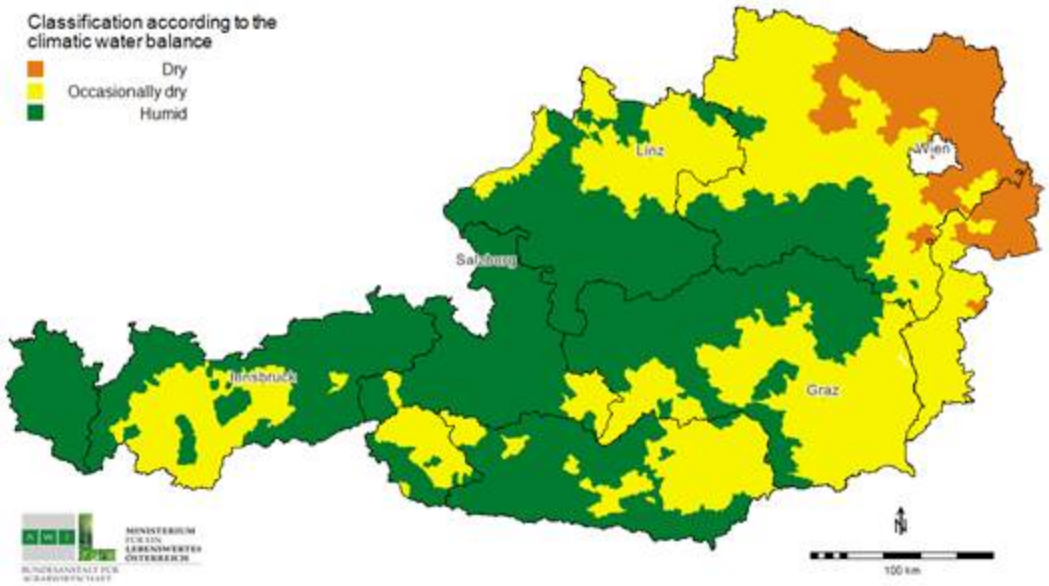


Number of documented crop yields

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Org	132	128	125	131	122	122	117	109	115	113	117	113	111
Conv	447	421	386	354	331	332	318	306	282	278	273	263	235

Dry and humid agricultural areas

- The Climatic water balance is calculated by the difference of precipitation and evapotranspiration
- The climate data is based on records between 2003-2015



Source: Own illustration based on Formayer , 2016

Cereals - Crop yields per hectare
Dry/humid agricultural areas

		Humid			Occassionally dry			Dry		
		Org	Conv	Relative*	Org	Conv	Relative*	Org	Conv	Relative*
Common Wheat	dt/ha	35.8	64.7	55%	33.7	57.8	58%	35.8	48.8	73%
	n	149	1834		763	5544		421	2893	
Rye	dt/ha	31.7	45.7	69%	26.0	43.8	59%	26.3	40.6	65%
	n	170	345		961	1839		184	536	
Winter barley	dt/ha	37.7	57.7	65%	34.7	56.5	61%	30.7	48.7	63%
	n	108	2039		310	4619		78	774	
Summer barley	dt/ha	27.4	39.9	69%	27.6	40.0	69%	26.6	42.1	63%
	n	85	657		521	3004		153	2291	
Oat	dt/ha	26.4	44.3	60%	28.1	41.5	68%	30.0	35.8	84%
	n	162	889		763	1891		58	85	
Triticale	dt/ha	39.2	55.9	70%	36.4	50.9	71%	30.2	46.4	65%
	n	258	1277		925	3075		125	209	
Corn	dt/ha	61.7	100.2	62%	62.4	96.7	65%	57.1	76.8	74%
	n	40	959		236	4311		235	1425	
Millet	dt/ha				23.1	56.1	41%	18.8	36.4	52%
	n				25	100		50	228	
Spelt	dt/ha	21.4	23.8	90%	23.5	39.7	59%	27.3	39.3	70%
	n	82	49		584	128		160	48	

dt/ha = weighted average yield in decitonnes per hectare ; n= number of documented yield data between 2003-2015; *Relative yields organic to conventional

Oilseed and protein crops - Crop yields per hectare dry/humid agricultural areas

		Humid			Occassionally dry			Dry		
		Org	Conv	Relative*	Org	Conv	Relative*	Org	Conv	Relative*
Field peas	dt/ha		26.8		14.3	22.5	63%	13.7	25.3	
	n		227		274	920		201	735	
Fava beans	dt/ha	26.3	31.0	85%	19.1	25.4	75%	13.8		54%
	n	30	122		198	198		69		
Soybean	dt/ha		26.0		19.7	26.2	75%	23.0	21.3	108%
	n		361		121	1292		90	122	
Rapeseed	dt/ha		33.6			30.5			26.4	
	n		543			1718			965	
Sun flower	dt/ha		20.6		14.1	24.5	57%	19.1	26.0	73%
	n		36		67	681		43	1245	
Oil pumkin	dt/ha				4.3	5.5	79%	4.5	5.7	78%
	n				194	1739		149	205	

dt/ha = weighted average yield in decitonnes per hectare ; n= number of documented yield data between 2003-2015; *Relative yields organic to conventional

Further work packages

WP - Survey

Use of clover and alfalfa (just mulching or additional use) of farms **without** livestock.
Correction of results if there is no utilization.

WP – Matching procedure

The purpose of this work package is to find comparable farms (organic to conventional) with similar production conditions (eg. size, area, produced crops, crop rotation)

Conclusion

- Strong demand to have empiric data of yields (different stakeholders)

- Organic farming at arable land produces in average lower yields than conventional farming (average app. 66%). Extend of yield gaps depend on:
  - Crops (cereals, oil crops, root crops, protein crops)
  - Region → in dry areas less disparity than in humid areas for main crops like wheat and corn (use of water capacity)
  - Disparity between organic and conv. crop yield is rising (advanced breeds)
  - Remain the utilizations (food, feed, energy) the same - decreases the self-sufficiency rate