



# Organic vs. conventional farming: Yields, variability and explanations

1. Why a study on yields
2. Coverage, methods and tools
3. Results
4. Synthesis and conclusions

## Why a study on yields





Limited **data availability** on **organic production** and **yields**

Risks of **non reliable declarations** on yields and productions

Difficulties in **checking/challenging figures** where **clear and reliable reference sources** are missing

## Objectives

Analysing the **variability of yields** for different selections of **crops** in a number of **countries**

**Variation in time**, among different **regions** and/or **farm types**, between **conventional** and **organic** farming

Exploring **the reasons behind variability** and defining **credible ranges of variation**





# Coverage, methods and tools



	Russia	Kazakhstan	Ukraine	Moldova	Turkey	Lebanon	Morocco	Algeria	Tunisia	China	Philippines
All wheat (soft wheat)	✓	✓	✓	✓							
Durum wheat	✓	✓	✓								
Corn	✓	=	✓	✓							
Lentils	✓	=	✓	✓							
Peas, dry	✓	=	✓	✓							
Rapeseed	✓	✓	✓	✓							
Sunflowerseed	✓	✓	✓	✓						✓	
Apricots					✓						
Hazelnuts					✓						
Cherries					✓						
Figs					✓						
Strawberries					✓		✓				
Rice										✓	
Tea										✓	
Olives						✓	✓		✓		
Argan							✓				
Citrus fruits							✓				
Dates								✓			
Sugar cane											✓



yield data available for both conventional and organic farming



yield data available for conventional farming only



yield data not available neither for conventional nor for organic farming



**11 Extra-EU Countries**

**18 Crops**

**40 Country-Crop combinations**

- **Quantitative evidence for the analysis** was collected through a combination of:
  - **Desk research:** relevant databases and datasets from official or anyway authoritative sources (*business associations; research institutions*); relevant technical and scientific literature, including online resources.
  - **Interviews with knowledgeable local experts.**
- Besides sources in English language, sources in the relevant national languages were also analysed.

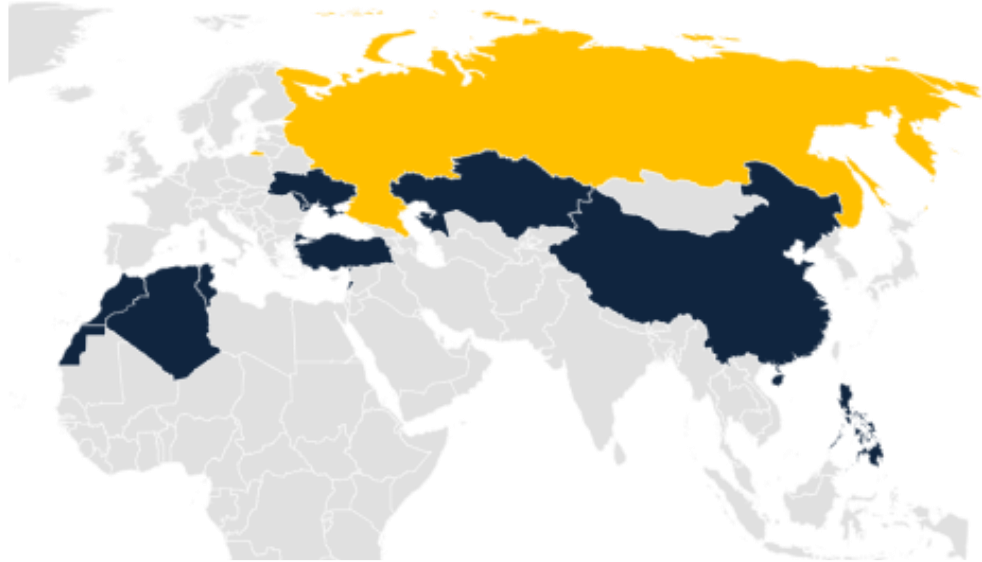


- Quantitative indications about the **variability of yields among the different regions of a country, or among different farm typologies**, are provided where available.
- Variability of yields over time and differences in yield between conventional and organic farming are analysed through **descriptive statistics tools** (*period averages, minimum-maximum values, variance, standard deviation, trends over the observed periods*).

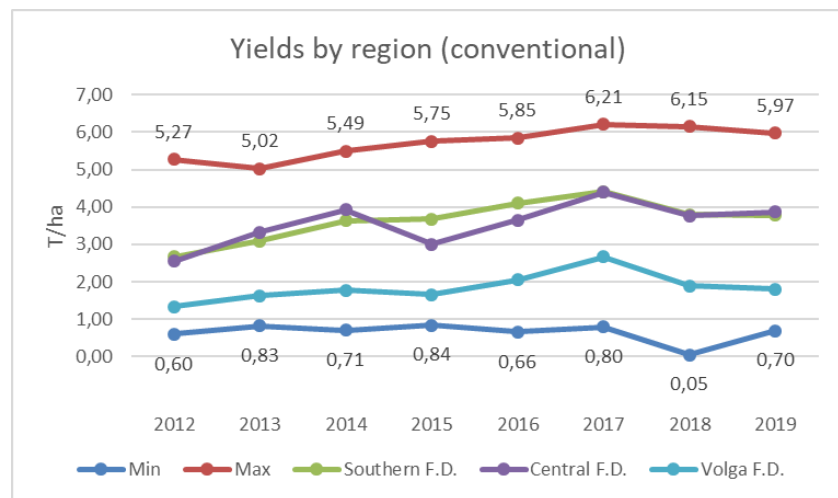
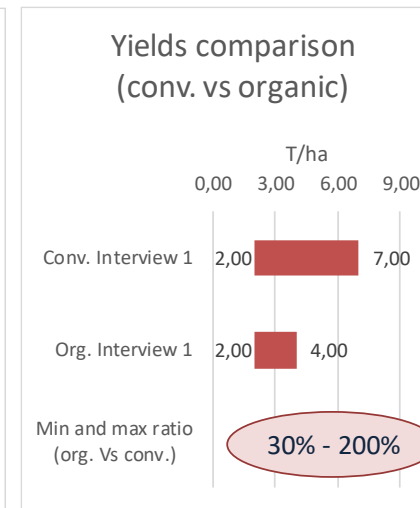
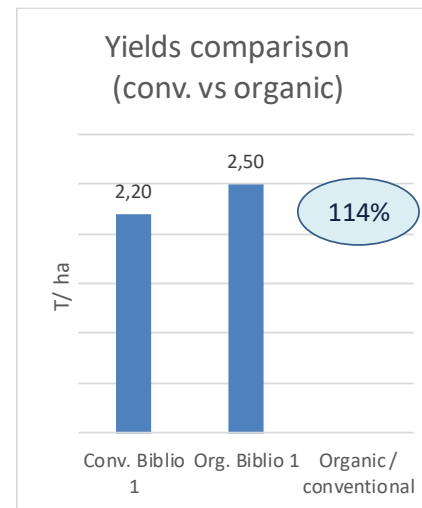
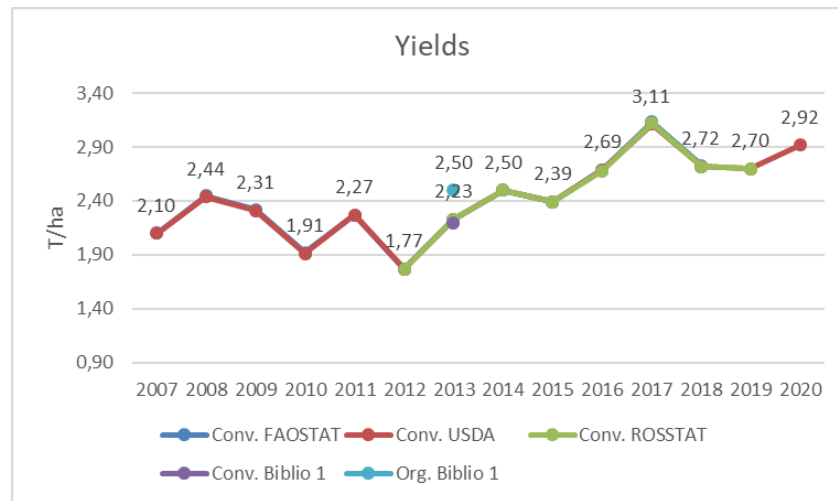
# Results







**Russia**

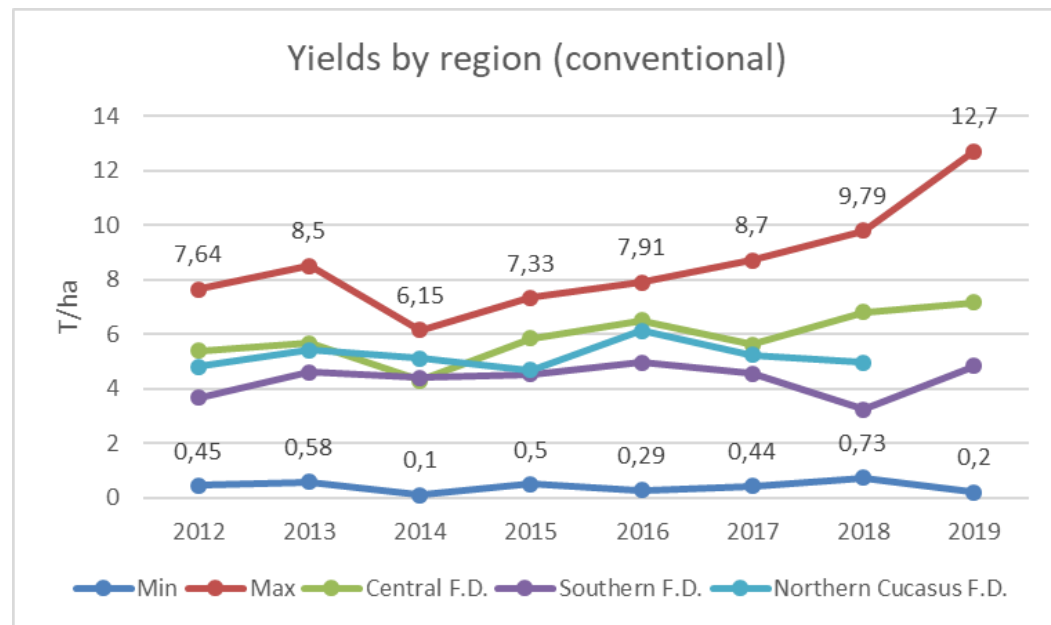
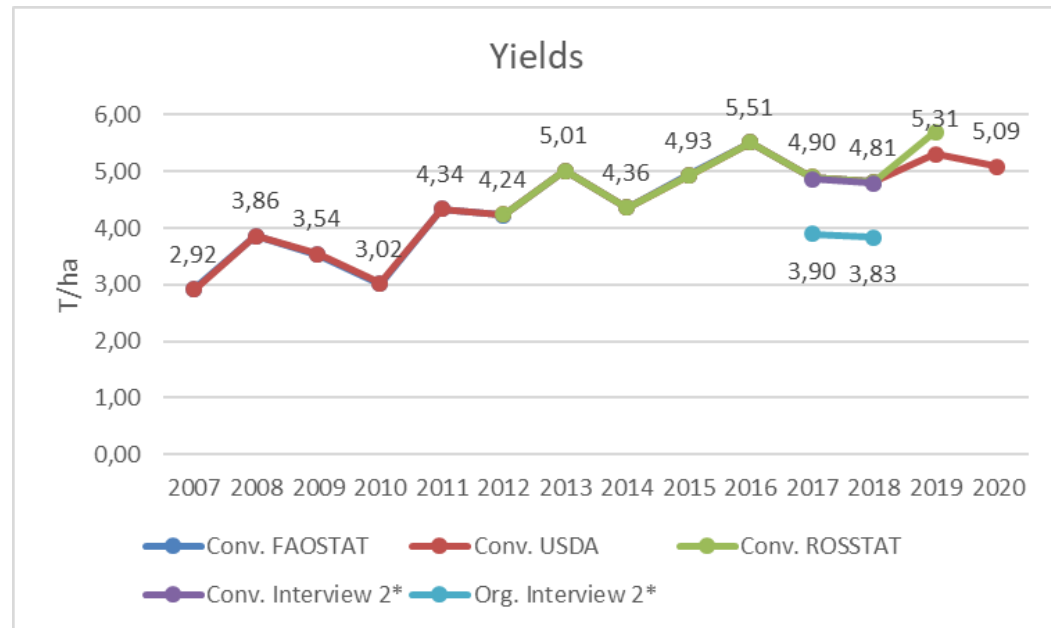


#### Yields variability (avg. USDA-ROSSTAT – T/ha): 2007-2020

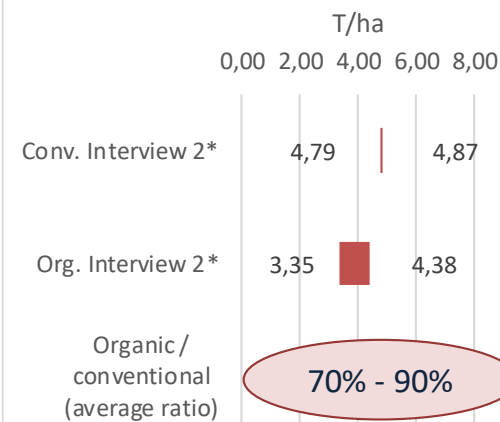
Average (conv): 2,47  
 Min – Max: [1,77 - 3,12]  
 Var: 0,15  
 Std. Dev.: 0,42  
 Growth last 3 years avg on first 3 years avg: 26%

#### Main results

- Organic yields **generally higher** than conventional ones, mainly because of **higher efficiency** of organic farms and **location in more fertile areas** (based on 2013 data)
- Relatively **low variability** of yields **over the period**
- Significant variability** of yields **among** the different **regions** → organic yields may be much lower or much higher than conventional ones
- Min. and max. yields of main producing areas (Southern, Central and Volga districts) fall in the [1,80-3,78 t/ha] range



### Yields comparison (conv. vs organic)



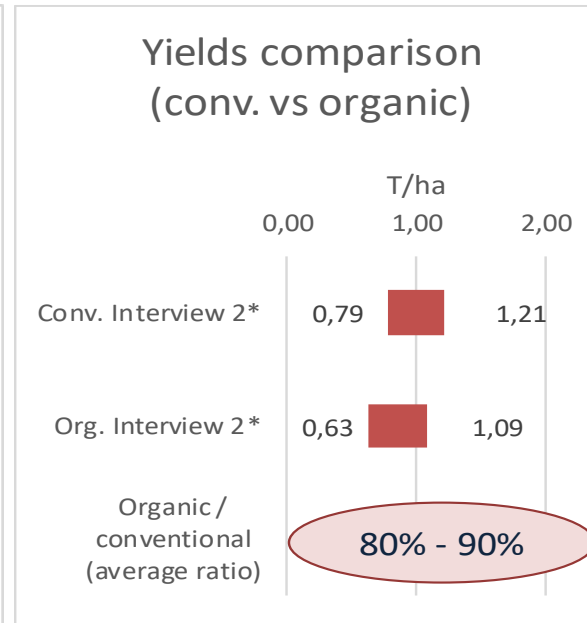
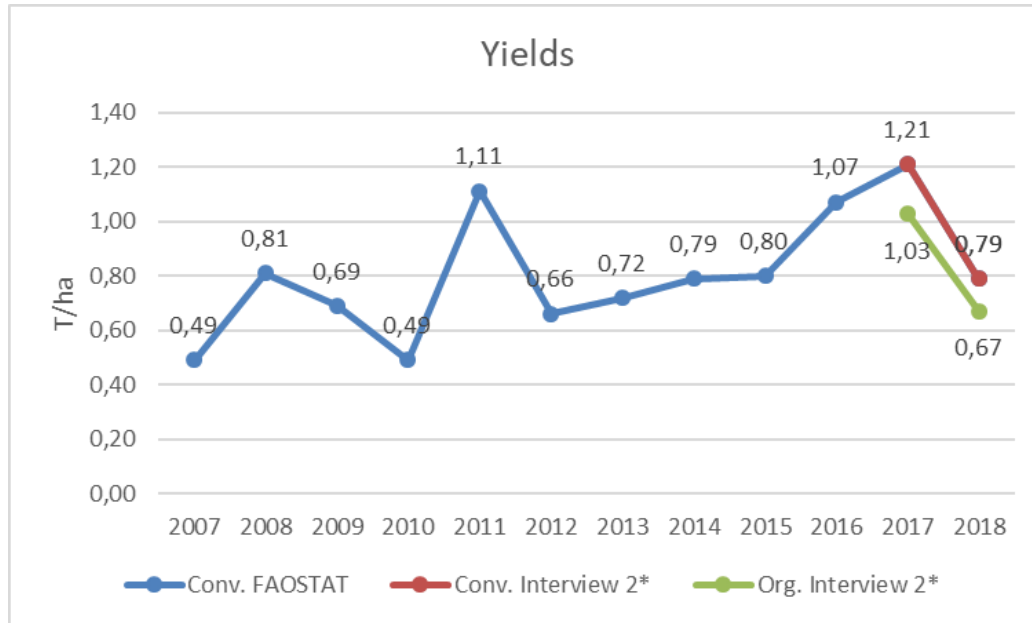
### Yields variability (avg. USDA-Rosstat – T/ha): 2007-2020

- Average (conv): 4,46
- Min – Max: [3,58 - 5,61]
- Var: 0,46
- Std. Dev.: 0,66
- Growth last 3 years avg on first 3 years avg: 30%

### Main results

- **Organic yields generally between 70% and 90% of conventional yields**, mainly because of **soil-born diseases and insects**
- **Significant variability of yields among the leading producing regions** (Central Federal District, Southern Federal District, North Caucasus Federal District), where min. and max. yields fall in the [4,85 – 7,16] t/ha range.





## Main results

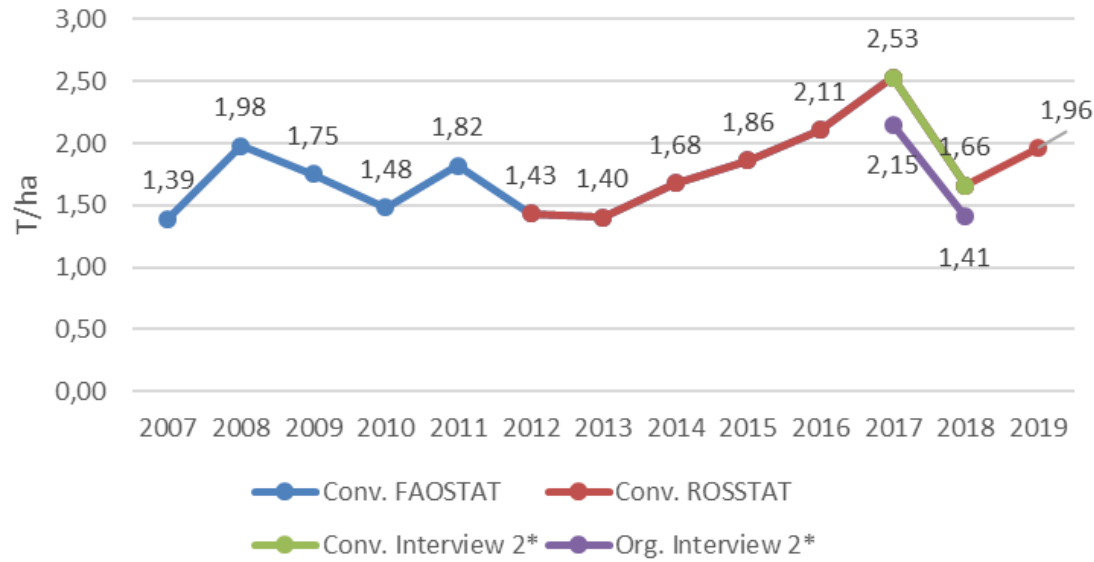
- Conventional yields **steadily growing** over the **2007-2017** period but decreasing in 2018
- At country level, conventional yields falling in the [0,5 – 1,2] t/ha range
- **Organic yields** generally **between 80% and 90% of conventional ones**, mainly because of **weeds competition** and **insects**

## Yields variability (FAOSTAT – T/ha): 2007-2018

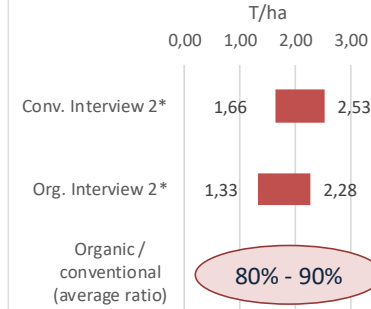
- Average (conv): 0,80
- Min – Max: [0,49 - 1,21]
- Var: 0,05
- Std. Dev.: 0,23
- Growth last 3 years avg on first 3 years avg: 54%



## Yields



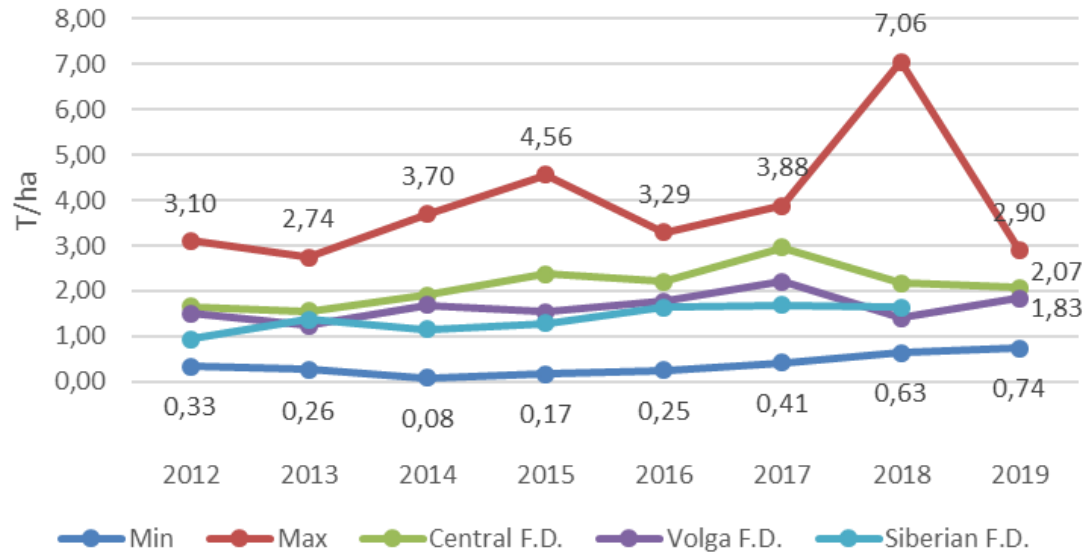
## Yields comparison (conv. vs organic)



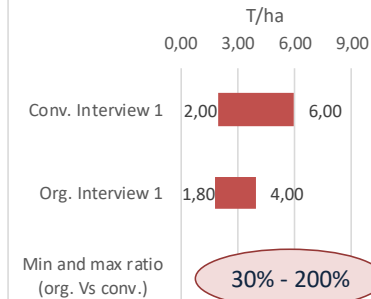
## Yields variability (avg. FAOSTAT-ROSSTAT- T/ha): 2007-2019

- Average (conv): 1,79
- Min – Max: [1,40 – 2,53]
- Var: 0,13
- Std. Dev.: 0,36
- Growth last 3 years avg on first 3 years avg: 30%

## Yields by region (conventional)

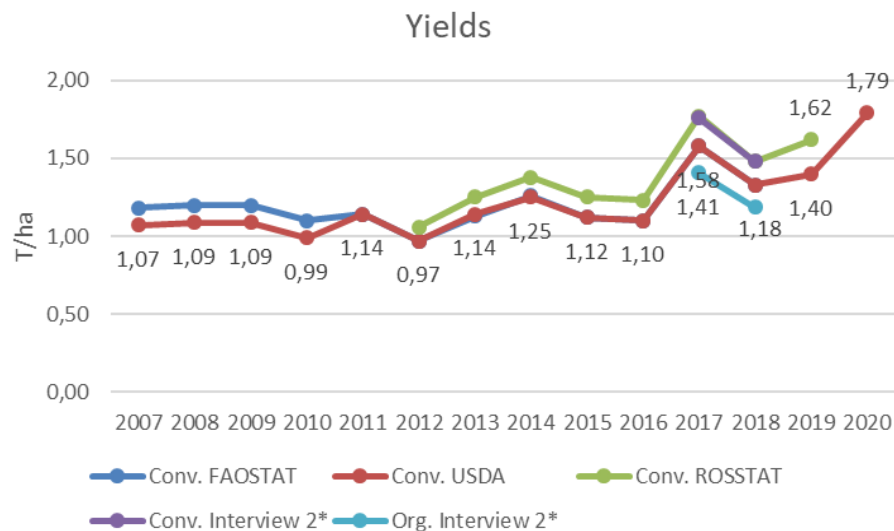
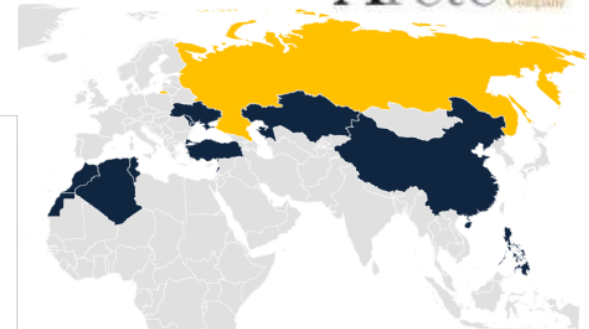


## Yields comparison (conv. vs organic)

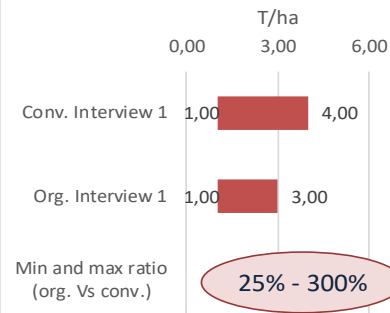


## Main results

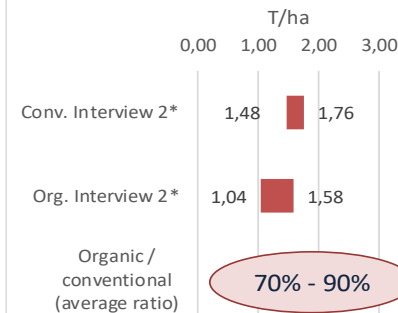
- **Growth of conventional yields over the 2007-2019 period** with three drops (2009-10, 2012-13 and 2018)
- **Organic yields** generally **slightly lower than conventional ones**, mainly because of **weeds competition** and **insects** (*much wider differences according to another interview*)
- **Variability of yields among the main producing regions**, where min. and max. yields fall in the [1,63 – 2,07] t/ha range



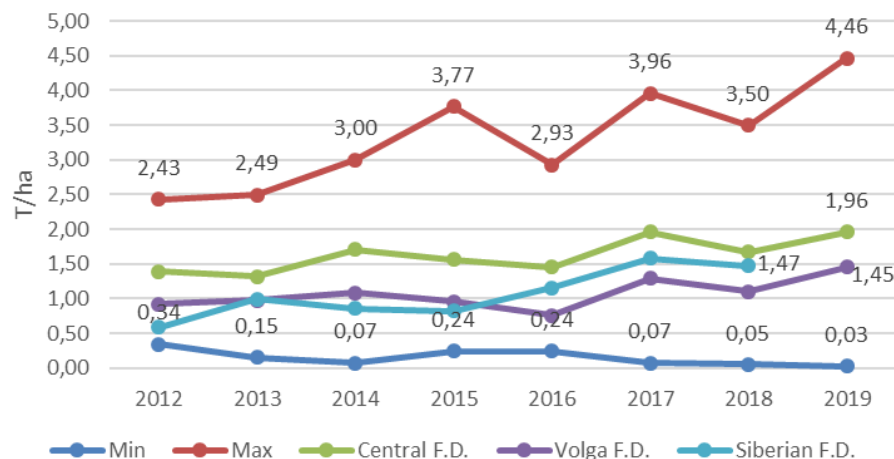
Yields comparison (conv. vs organic)



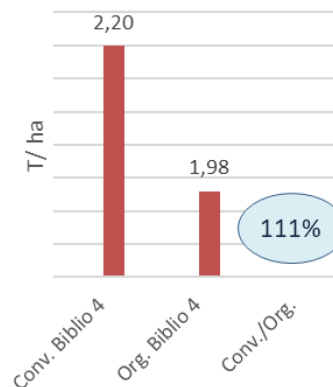
Yields comparison (conv. vs organic)



Yields by region (conventional)



Yields comparison (conv. vs organic)

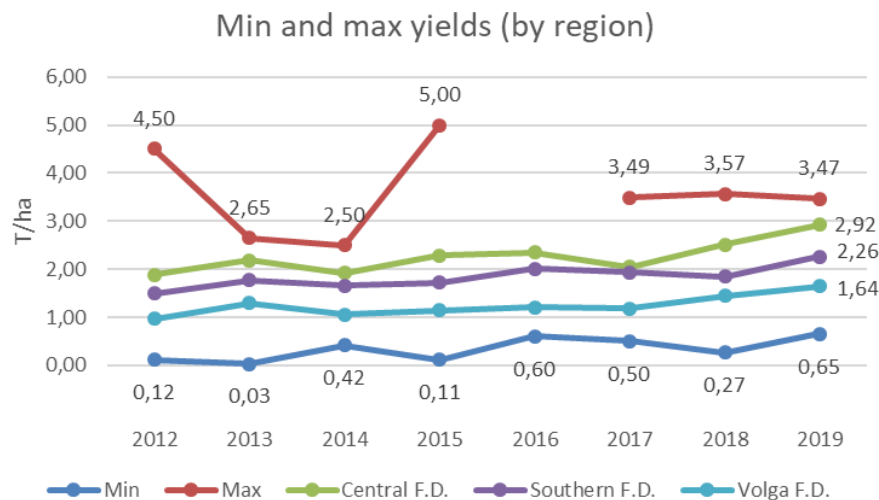
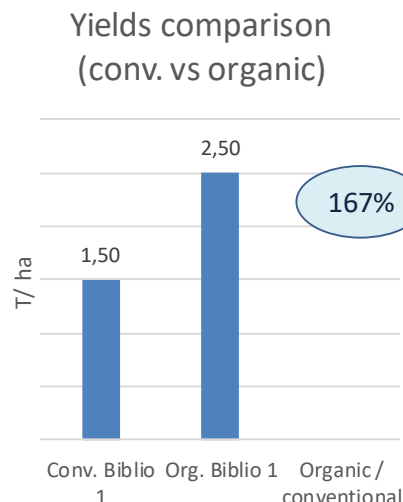
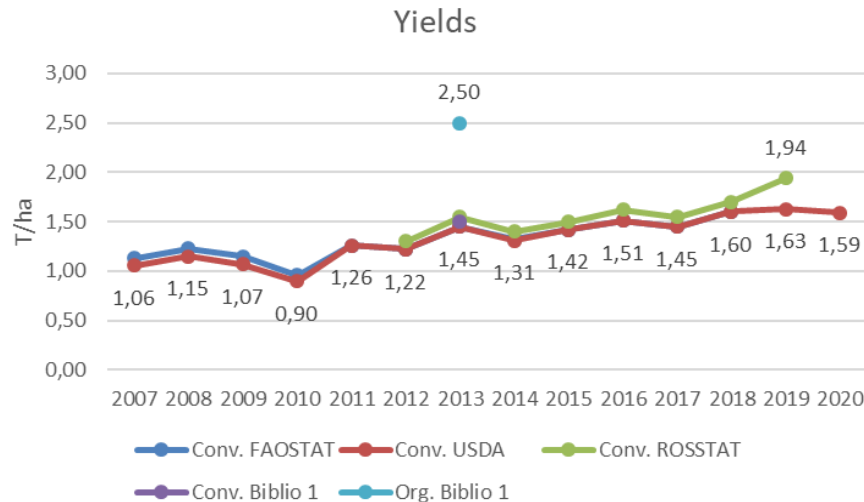
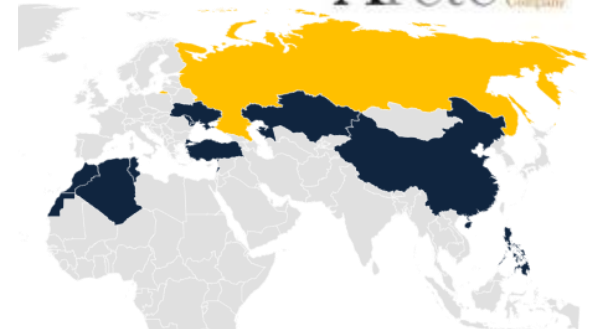


Yields variability (avg. USDA-ROSSTAT – T/ha):  
2007-2020

- Average (conv): 1,30
- Min – Max: [1,02 – 1,79]
- Var: 0,05
- Std. Dev.: 0,23
- Growth last 3 years avg on first 3 years avg: 36%

## Main results

- Conventional yields **steadily growing** with the exception of some years
- **Organic yields** generally **slightly lower** than conventional ones, with average ratio **between 70% and 111%**, mainly because of **nutrition deficit** and **insects** (much wider differences according to one interview)
- **Significant variability** among the main **producing areas**, where min. and max. yields fall in the [1,10 – 1,96] t/ha range



#### Yields variability (avg. USDA-ROSSTAT – T/ha): 2007-2019

- Average (conv): 1,45
- Min – Max: [1,10 – 1,79]
- Var: 0,04
- Std. Dev.: 0,21
- Growth last 3 years avg on first 3 years avg: 35%

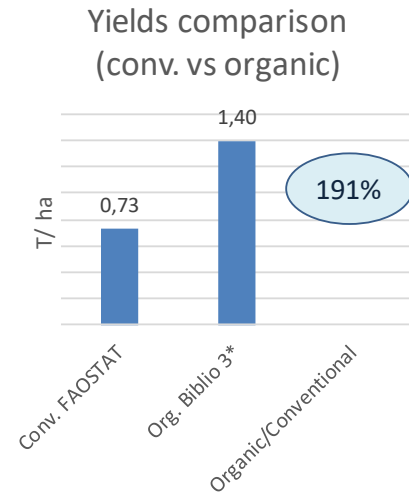
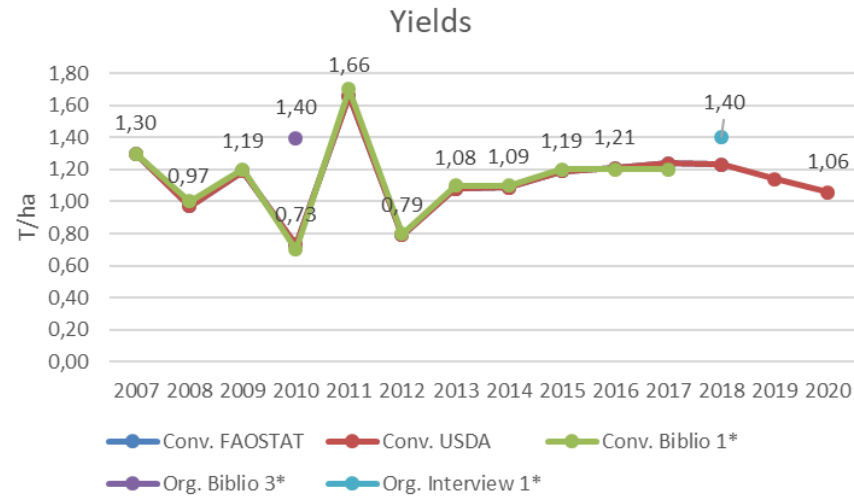
#### Main results

- **Organic yields generally higher than conventional ones**, mainly because of **higher efficiency** of organic farms and **location in more fertile areas** (based on 2013 data)
- **Relatively low variability** of yields **over the period**
- **Significant variability** of yields **among the leading producing areas**, where min. and max. yields fall in the [1,64 – 2,92] t/ha range

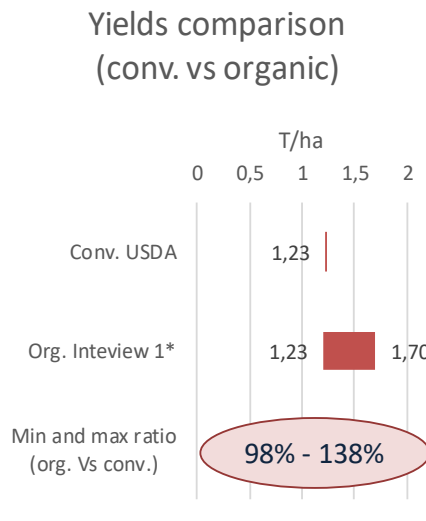
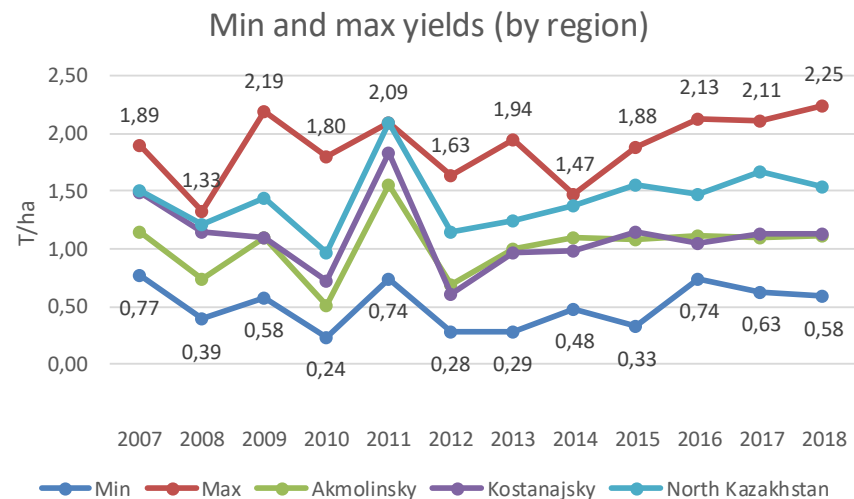


# Kazakhstan



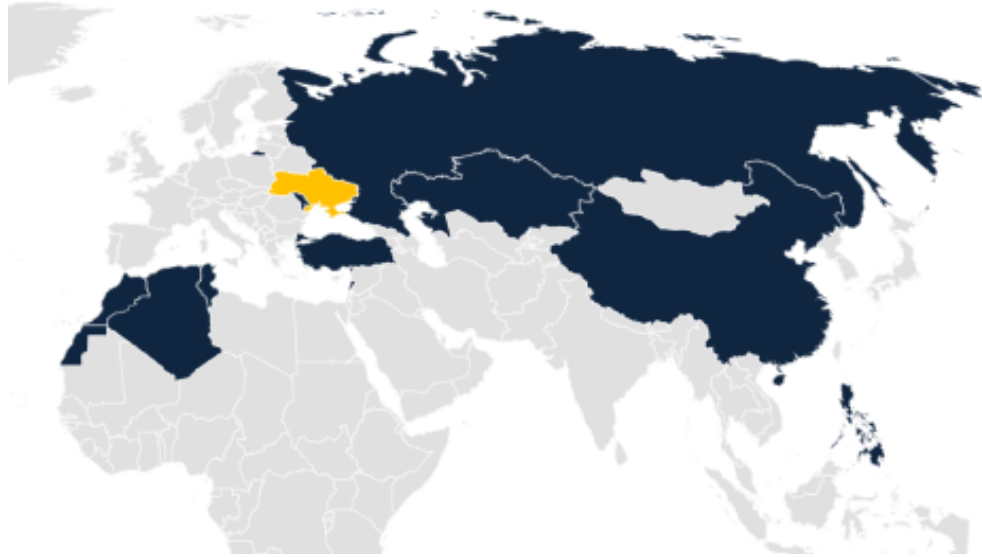


- ### Yields variability (USDA – T/ha): 2007-2019
- Average (conv): 1,13
  - Min – Max: [0,73 – 1,66]
  - Var: 0,05
  - Std. Dev.: 0,22
  - Growth last 3 years avg on first 3 years avg: - 1%

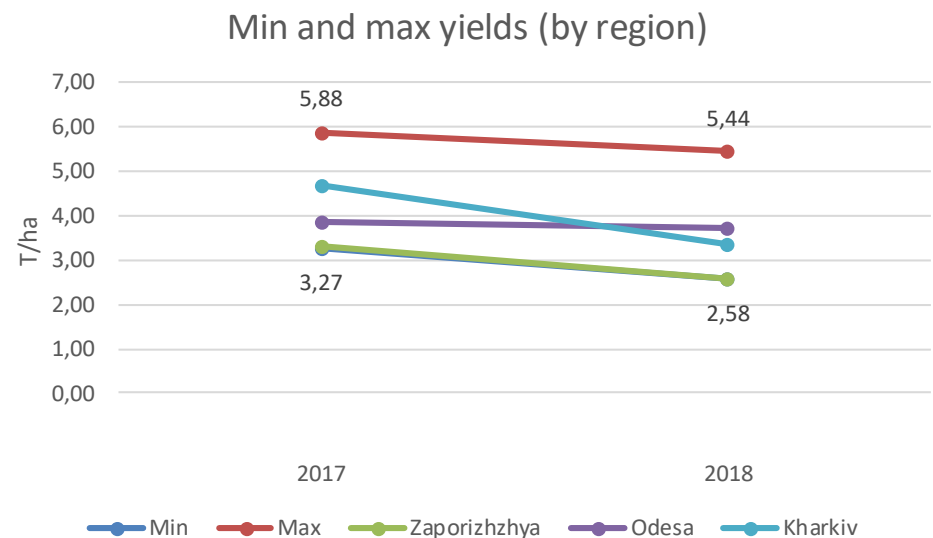
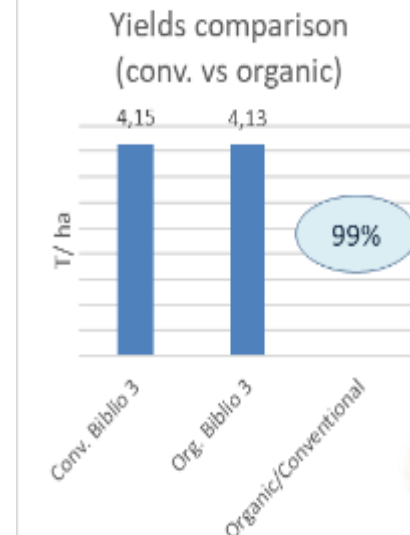
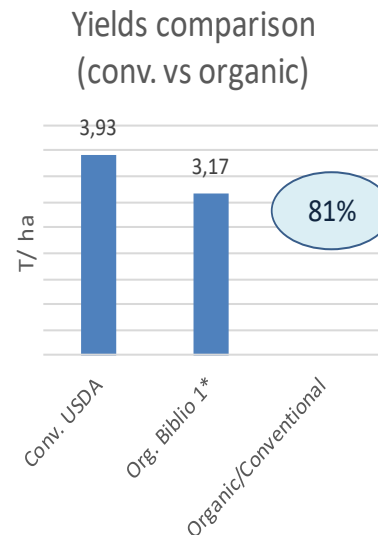
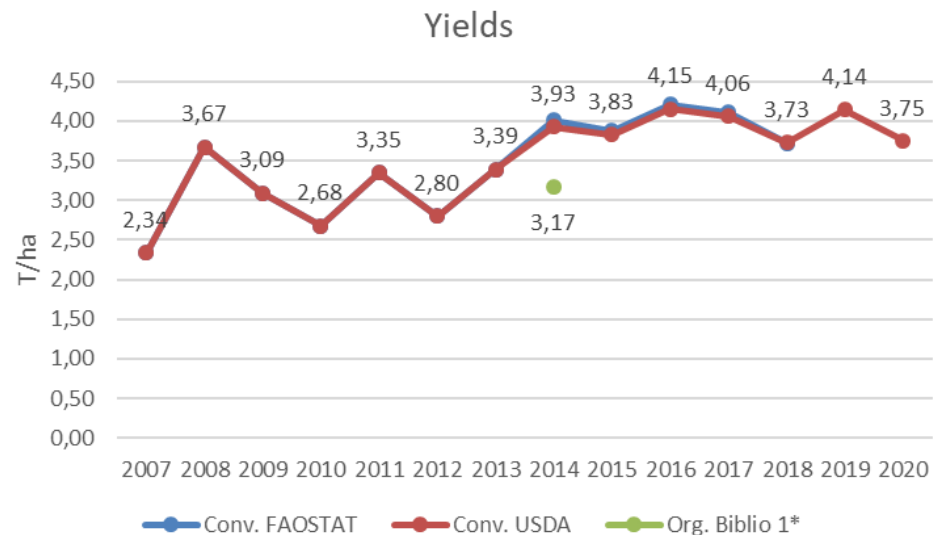


### Main results

- **Organic yields higher than conventional ones**, mainly because of **higher efficiency of organic farms** and **location in more fertile areas** (based on 2010 and 2018 data)
- **Relatively high variability of yields** over the 2007-2013 period; slowly decreasing trend in the last 4 years (2016 – 2020)
- **Significant variability of yields among the main producing areas** (Akmolinsky, Kostanajsky, North Kaz.), where avg. yields fall in the [0,5-1,9] t/ha range



**Ukraine**

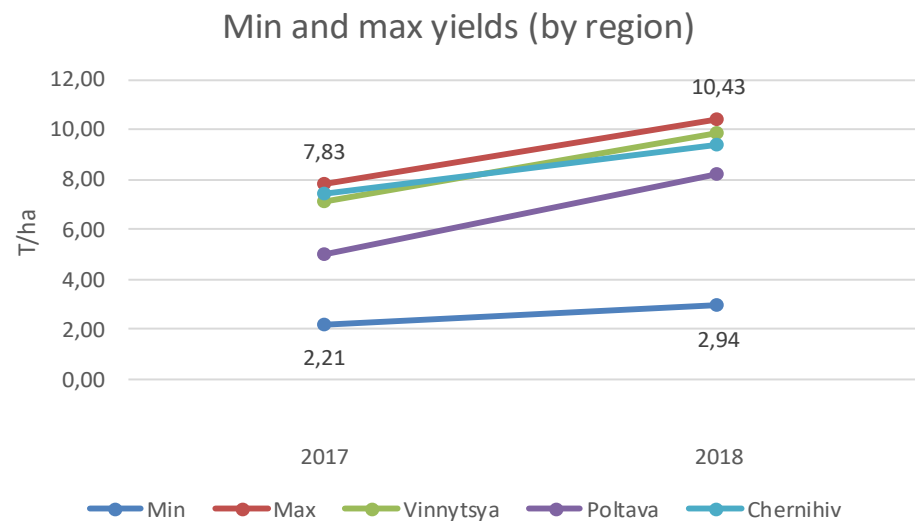
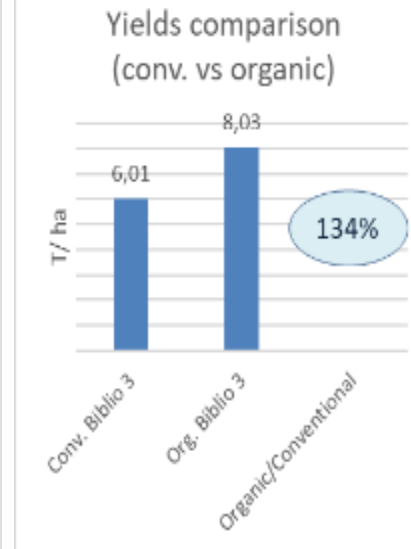
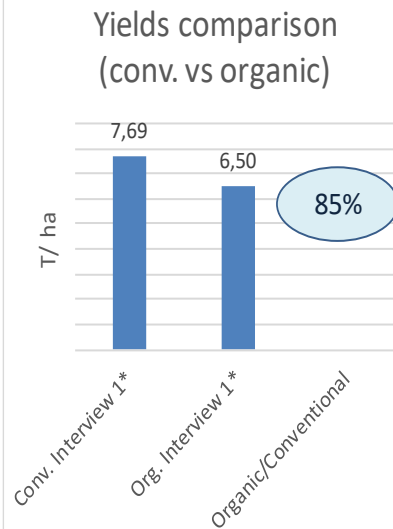
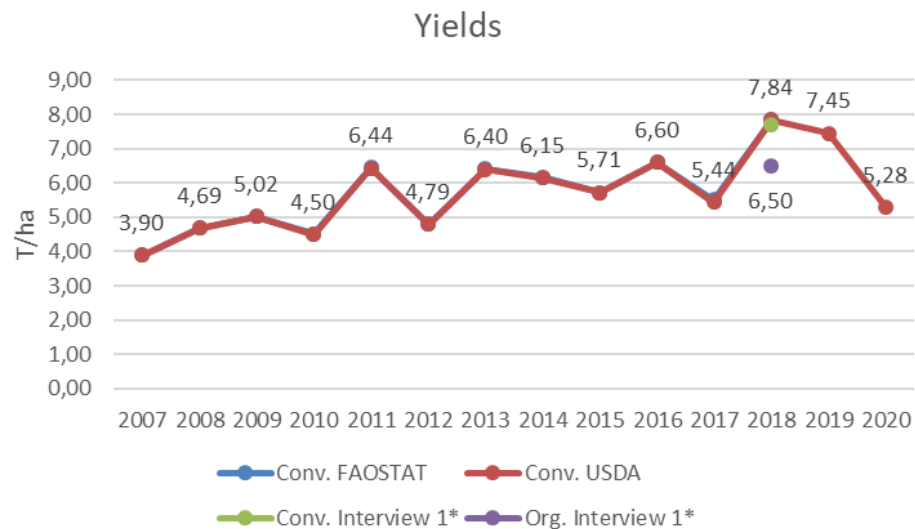


#### Yields variability (USDA – T/ha): 2007-2020

- Average (conv): 3,49
- Min – Max: [2,34 – 4,15]
- Var: 0,33
- Std. Dev.: 0,57
- Growth last 3 years avg on first 3 years avg: 28%

#### Main results

- **Organic yields slightly lower** than conventional ones.
- **Medium variability** of yields **over the period**
- **Significant yield variability across regions**, with min. and max. yields in the three main producing areas falling in the [2,58-3,73] t/ha range (2018)



#### Yields variability (USDA – T/ha): 2007-2020

- Average (conv): 5,73
- Min – Max: [3,90 – 7,84]
- Var: 1,30
- Std. Dev.: 1,14
- Growth last 3 years avg on first 3 years avg: 51%

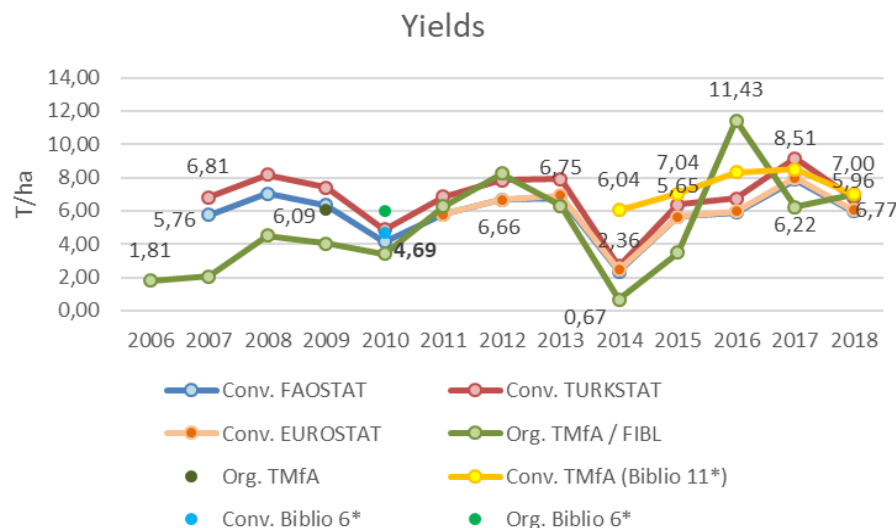
#### Main results

- **Organic yields from 85% to 134% of conventional ones;** main reasons :1) relatively low conventional corn yields in Ukraine and 2) organic enterprises larger and more efficient than conventional ones
- **Significant variability of yields** at country level **over the period**
- **Rather limited yield variability across the main producing areas** , where min. and max. yields fall in the [8,22 – 9,90] t/ha range (2018)

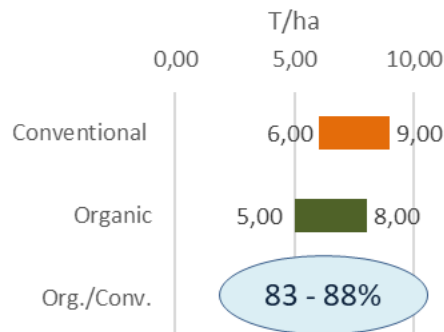




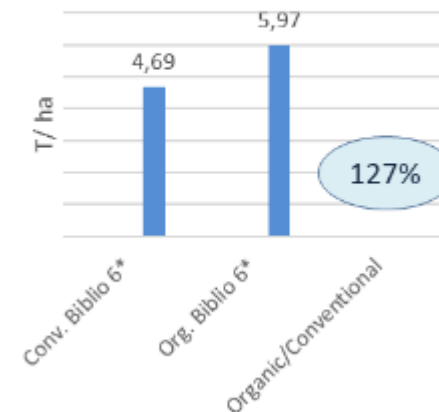
**Turkey**



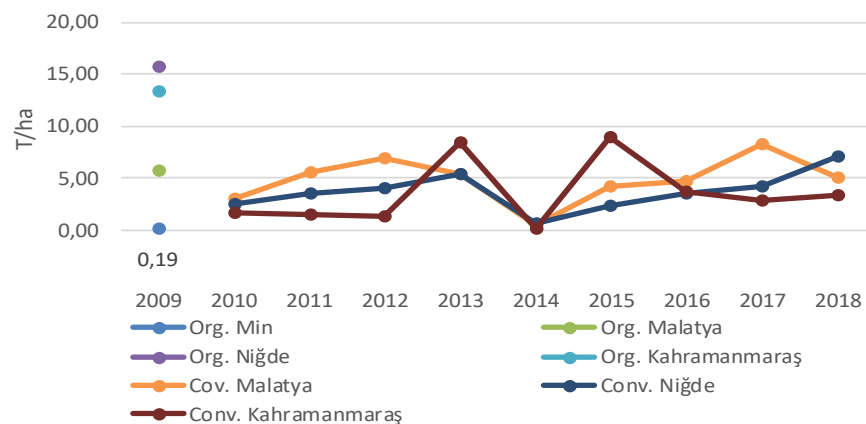
Yields comparison (org. vs conv.) - expert estimate



Yields comparison (conv. vs organic)

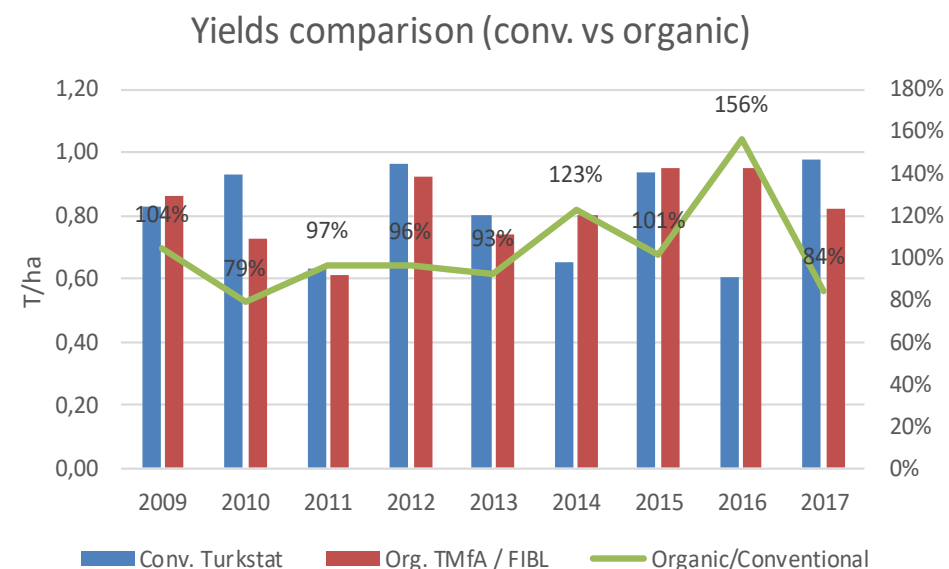
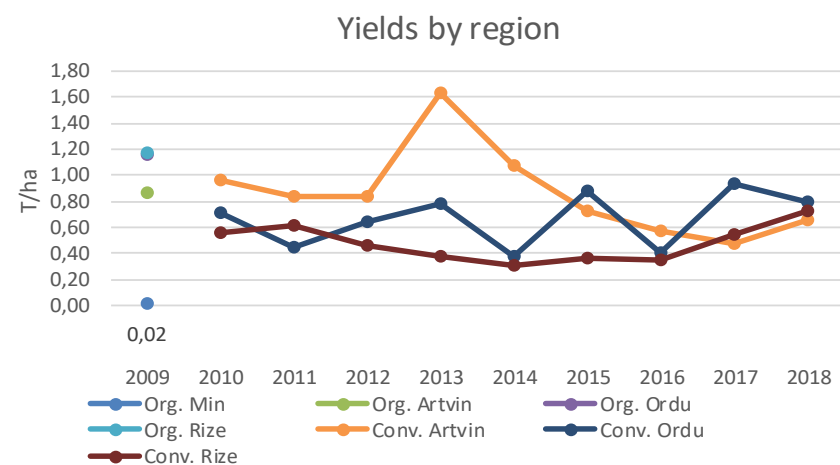
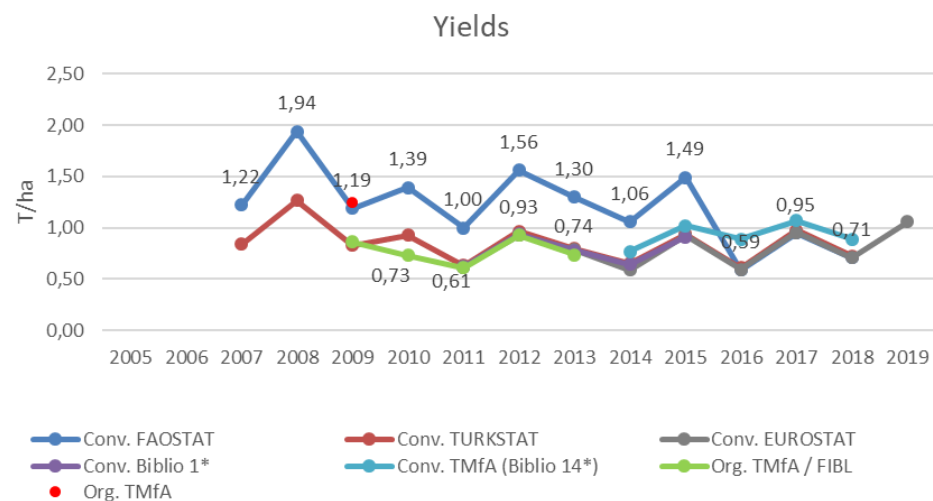


Yields by region

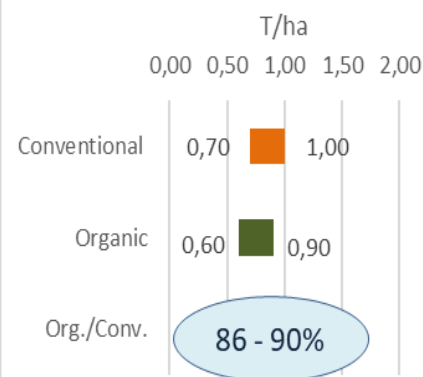


## Main results

- The most reliable sources reported **organic yields lower than conventional yields (between 83 and 88%)**, but organic yields may be higher than conventional ones according to some sources.
- Dimension of organic farms higher than conventional ones
- Organics yields in the main producing areas in the [5,8-15,7] t/ha range (2009 data).
- High variability of yields:** the yield is affected by **climate conditions** (frost, high rain in flowering period, drought), **diseases** and **pests**.



### Yields comparison (org. vs conv.) - expert estimate



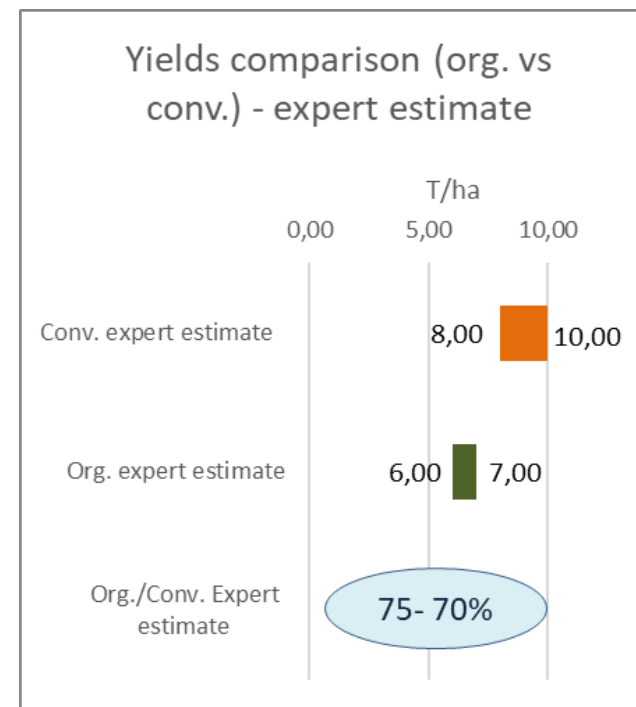
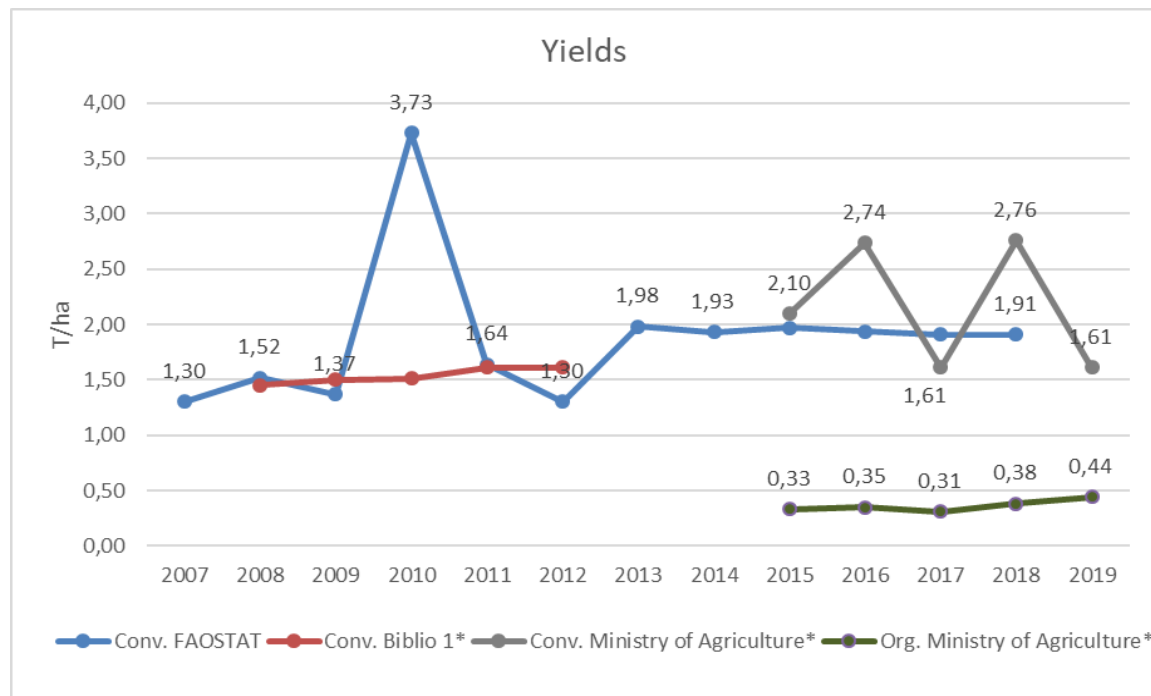
### Main results

- **Organic yields** generally in line with or slightly lower than conventional ones
- **Low variability** of yields over the period, with standard deviation of 0,19 for conventional and 0,11 for organic farming
- **Low variability** of organic yields in the **three main producing regions**, falling in the [0,86-1,18] t/ha range (2009 data)



**Lebanon**



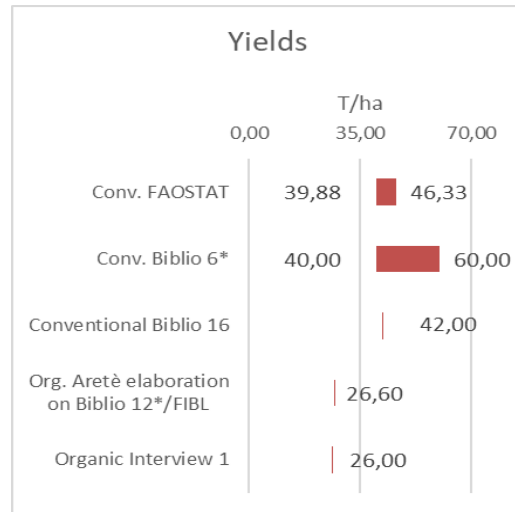
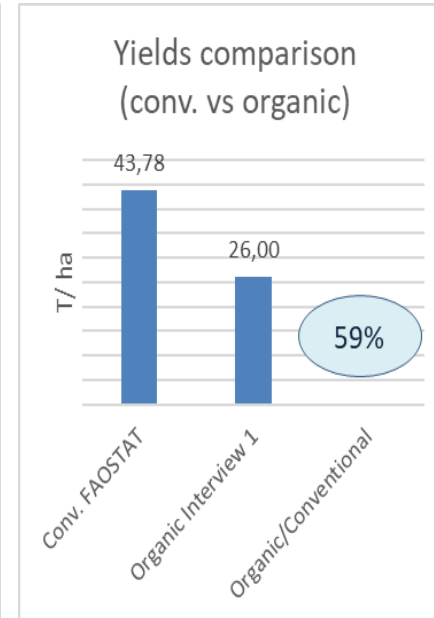
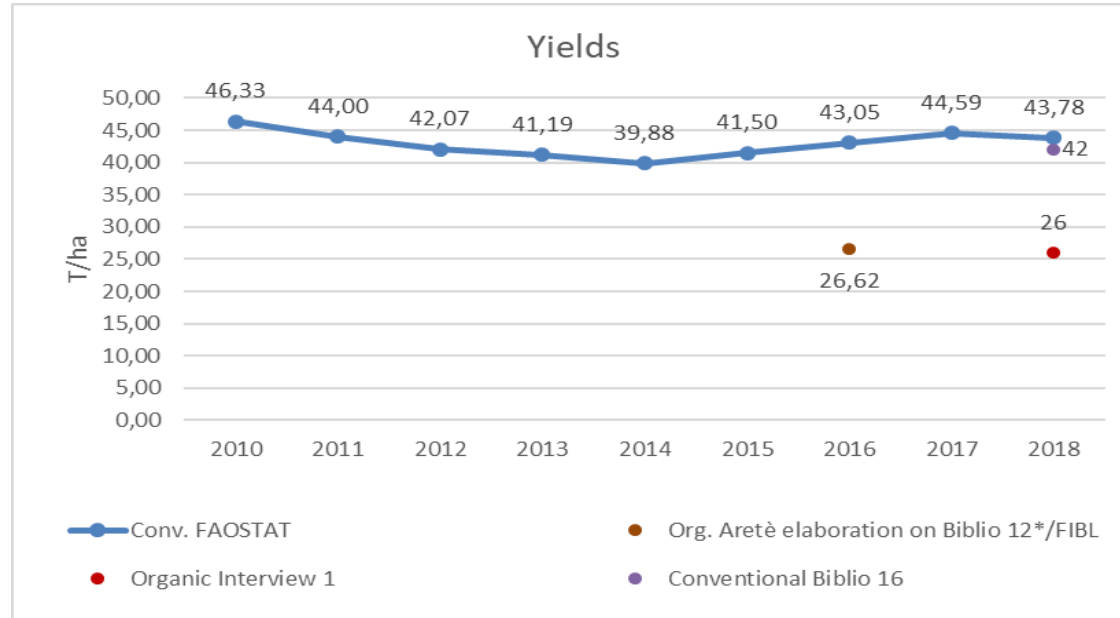


### Main results

- Data from FAOSTAT and the Ministry of Agriculture (Dept. of Statistics) are considered unreliable by local experts. Data seem to be often **underestimated by producers** for avoiding taxes and for having access to state aids.
- According to experts, there is a **high variability of yields over time**; however, on average, the **minimum organic yield is 75% lower** than the **minimum conventional yield** while the maximum organic yield is 70% lower than the maximum conventional yield.
- Conventional olive farming is not efficient** in Lebanon: main causes are **incorrect use of agro-chemicals, rainfed** (non-irrigated) **farming, old non productive trees**. Also the potential of organic farming has not been fully explored. When organic olives are cultivated with modern methods, the yields can be equal or higher than yields in traditional conventional farming (e.g. 10 ton/ha).



**Morocco**



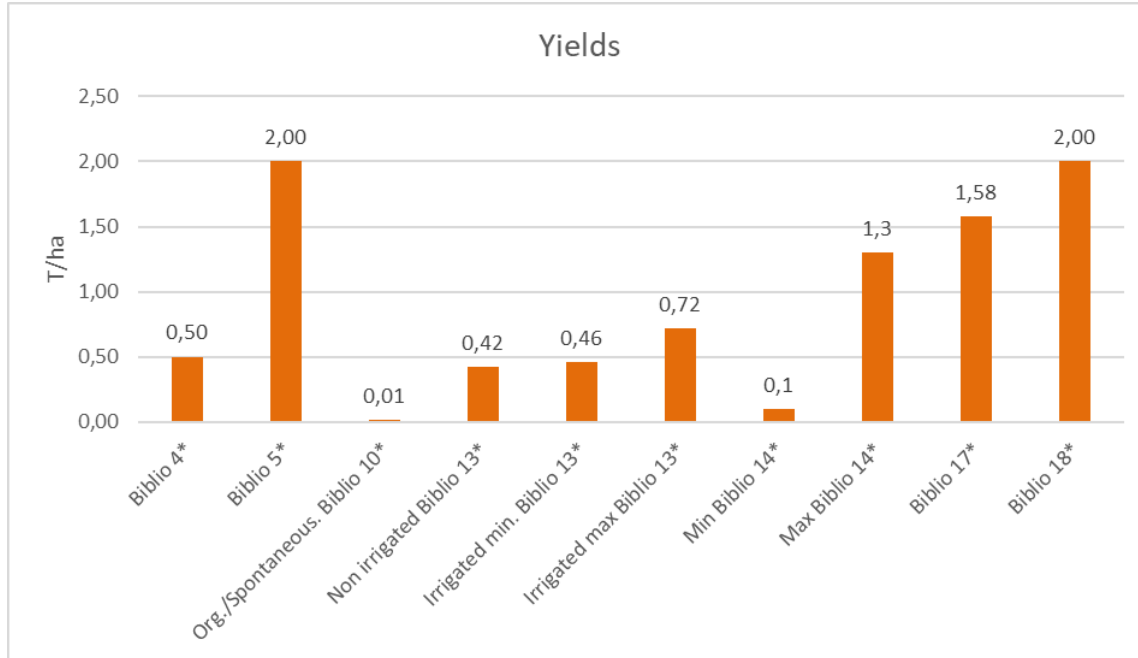
**Yields variability**  
**(Faostat – T/ha):**  
**2010-2018**

- Average: 42,93
- Min – Max: [39,88 – 46,33]
- Var: 3,91
- Std. Dev.: 1,98
- Growth last 3 years avg on first 3 years avg: -1%

**Main results**

- **Organic yields lower** than conventional ones, mainly because of the use of **high-input techniques** in **conventional farming**
- At **country level**, **very low variability** over the 2010-2018 period, with standard deviation of 1,98 in the same period, yields remained basically stable.



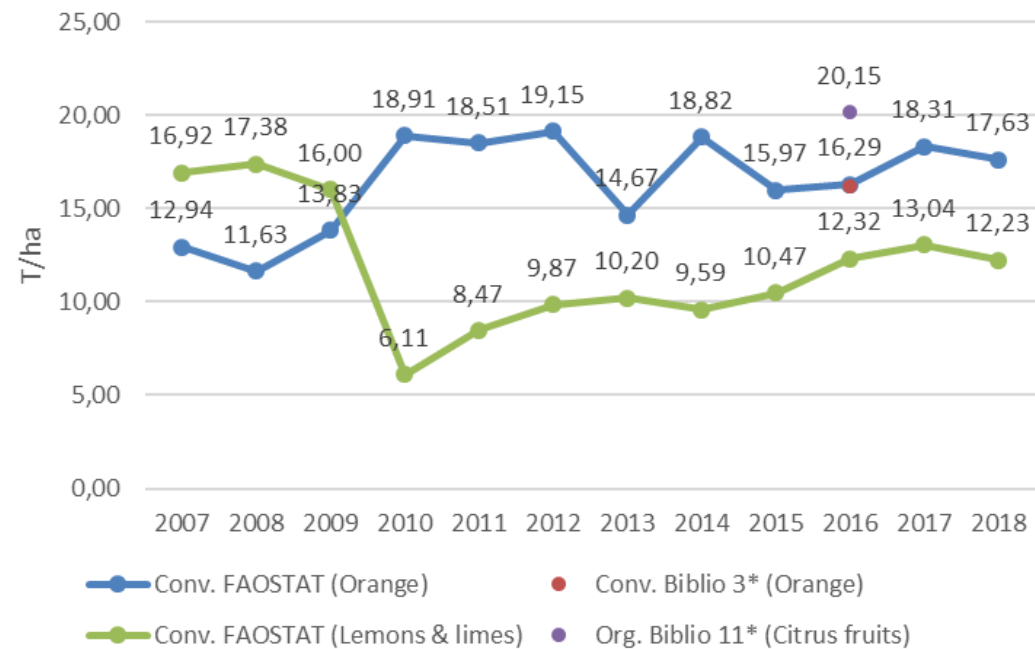


## Main results

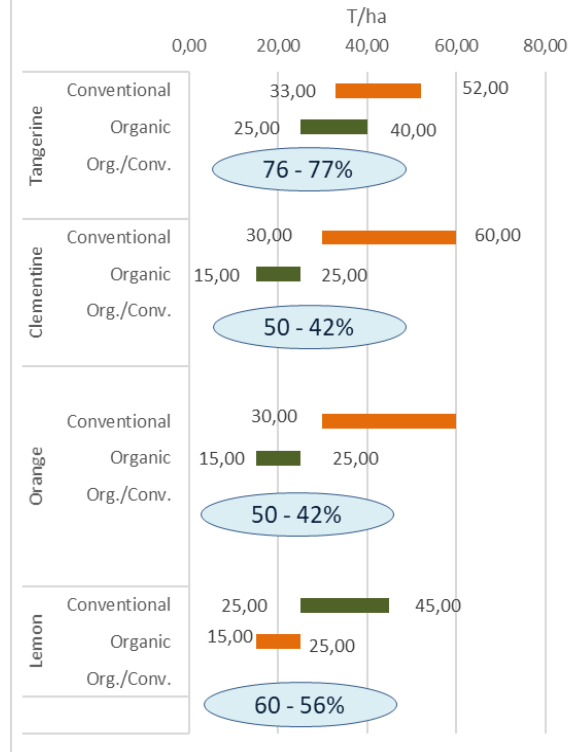
- Expert confirmed that the **yields of organic and conventional argan** are **very similar** and that other factors impact on yields.
- Yields generally falling between 0,01 and 2,00 t/ha
- The estimation of yields of Argan tree varies **depending on the regions** where the plantation is based and on the **tree ecotypes**.
- Impact on yields from the **use of old or young trees** (older trees are generally more productive)
- **Alternation phenomenon** in the Argan tree is very common: some trees produce fruit every year, others every two years and others more than every three years.



## Yields



## Yields comparison (org. vs conv.) - expert estimate

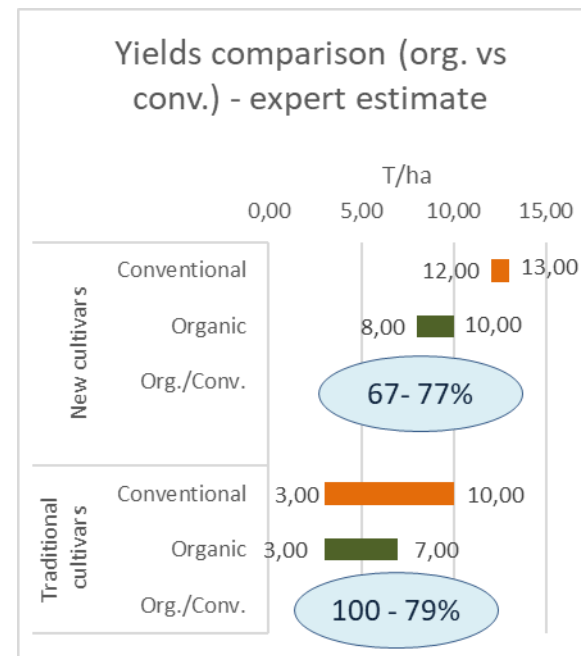
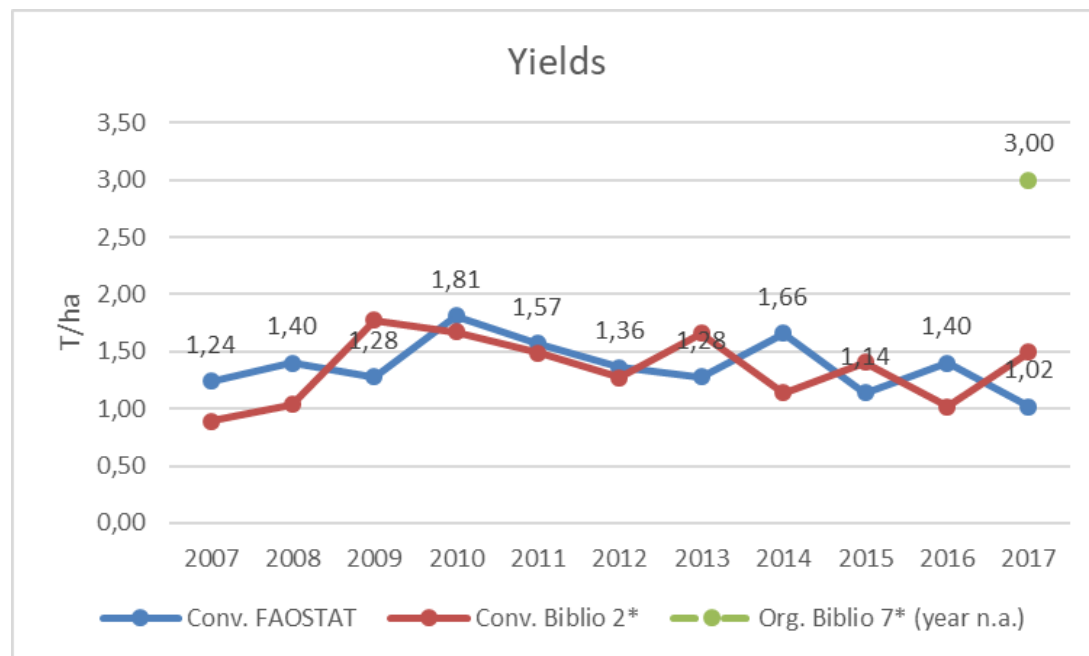


Variety	Trees/ha	Years of Production	Org. ( t/ha)	Conv. T/ha
Nador cote (tangerine)	500	5	25	33
Nador cote (tangerine)	833	3	40	52
Clementine	416	15	25-35	33-45
Sidi aissa (clementine)	416	15	20-35	26-45
Navel (orange)	416	8	20-40	26-52
Lemon	416	4	15-25	20-33

## Main results

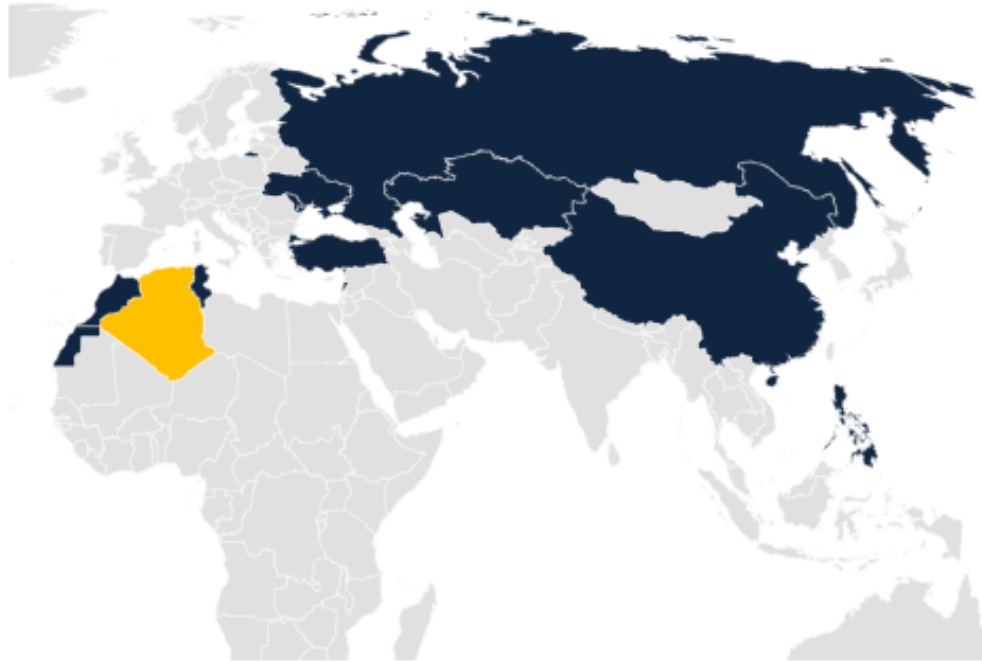
- According to local experts, the available data from official sources are not representative of the actual situation
- On average, **yield of conventional farming higher than organic farming by 30%.**
- Conventional and organic citrus yields differ depending on the **method of cultivation**, **density of plantation**, **location of plantations** and the **rootstock**
- Main differences in yields (both organic and conventional) are caused by the **variety of citrus fruit** (see table)



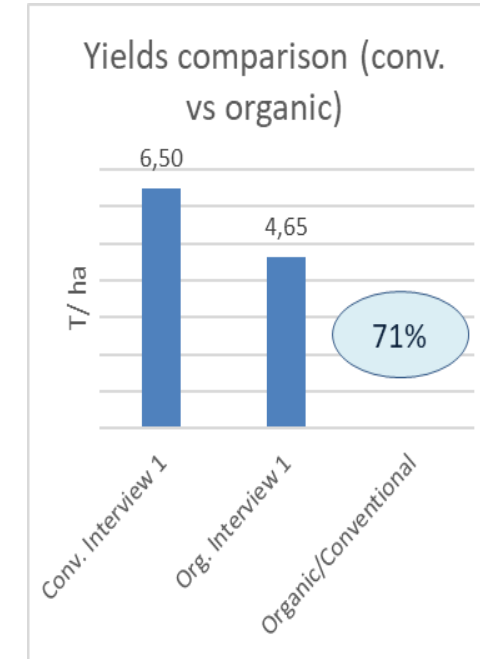
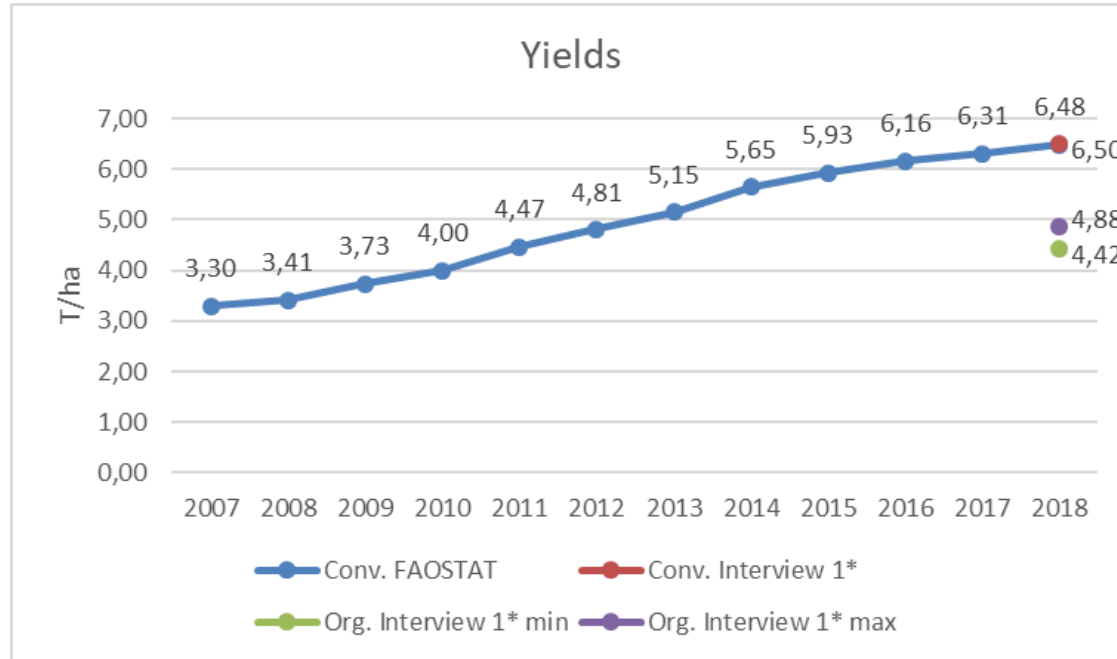


### Main results

- 12% of Moroccan olive plantations are organic
- Official data are considered not representative of the situation: based on this data, **organic yields are generally higher than conventional** ones.
- Ranges provided by different sources highlight the very high variability of both conventional and - especially - organic yields. Production is very variable across regions and alternation is also a typical feature of olive trees.
- Moroccan Picholine is the most common traditional variety in Morocco. The new olive tree plantations are mainly introduced varieties such as Arbequina, Arbosana and Koronaik. The most widespread is now Arbequina.
- Yields vary depending on the cultivar. New cultivars have higher yields than traditional cultivars. Organic new cultivars can have higher yields than conventional traditional cultivars.



**Algeria**

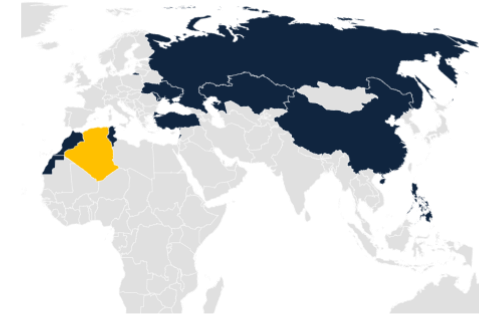


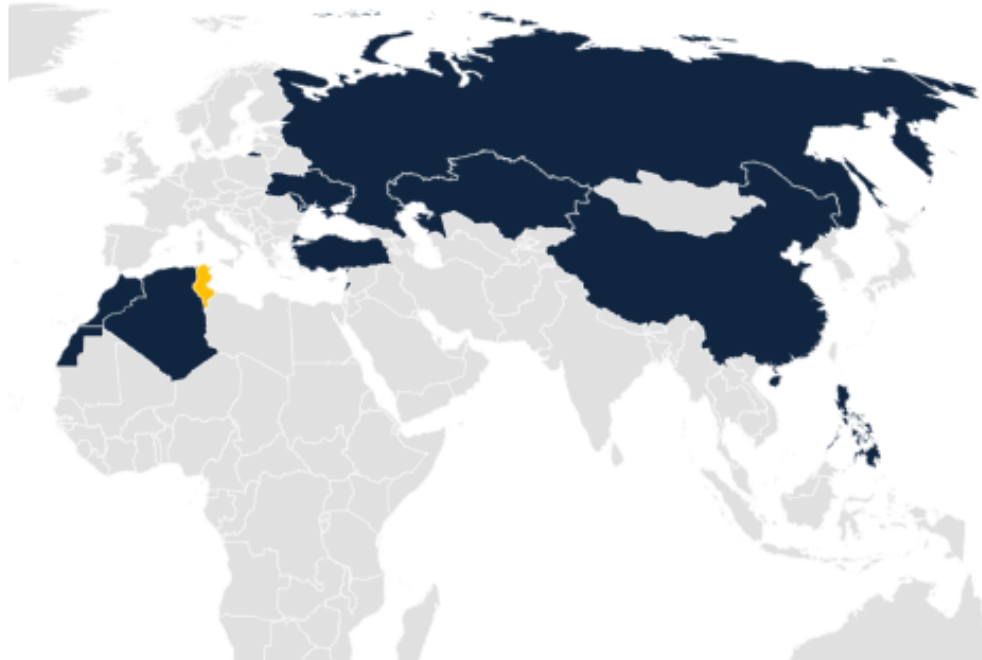
## Main results

- Significant and steady yield growth over the 2007-18 period
- **Medium variability over the observed period**, with standard deviation of 1,16
- **Organic yields are generally 25% - 32% lower than conventional ones**, mainly due to more limited use of agrochemicals
- Organic yields can be **even higher** than conventional ones, in particular when conventional trees are old or are located in less productive areas
- Key factors of productivity are **soil** and **climatic conditions**
- Large yield variability in conventional plantations caused by the **type of dates** and by the **area** where the plantation is located. The variation is lower in organic yields since only one date variety is cultivated with organic methods (Deglet Nour) and organic cultivation is carried out in limited areas.

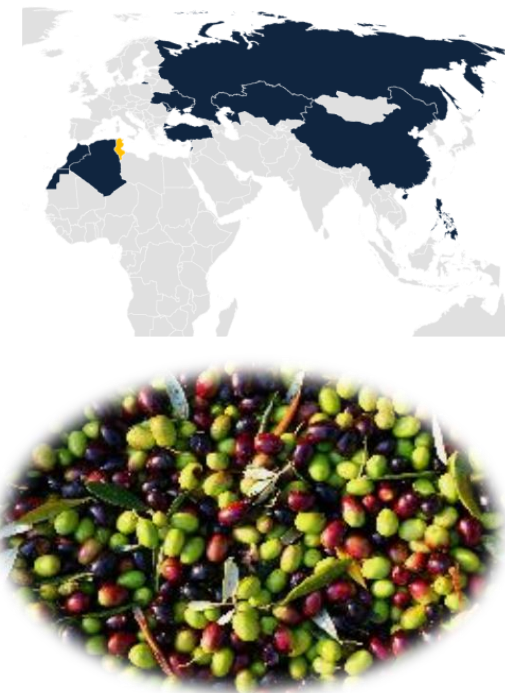
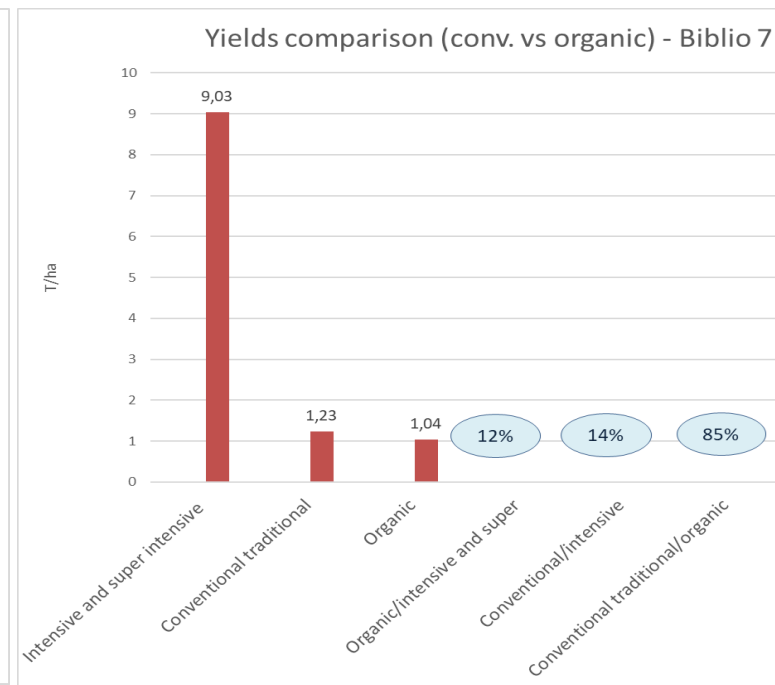
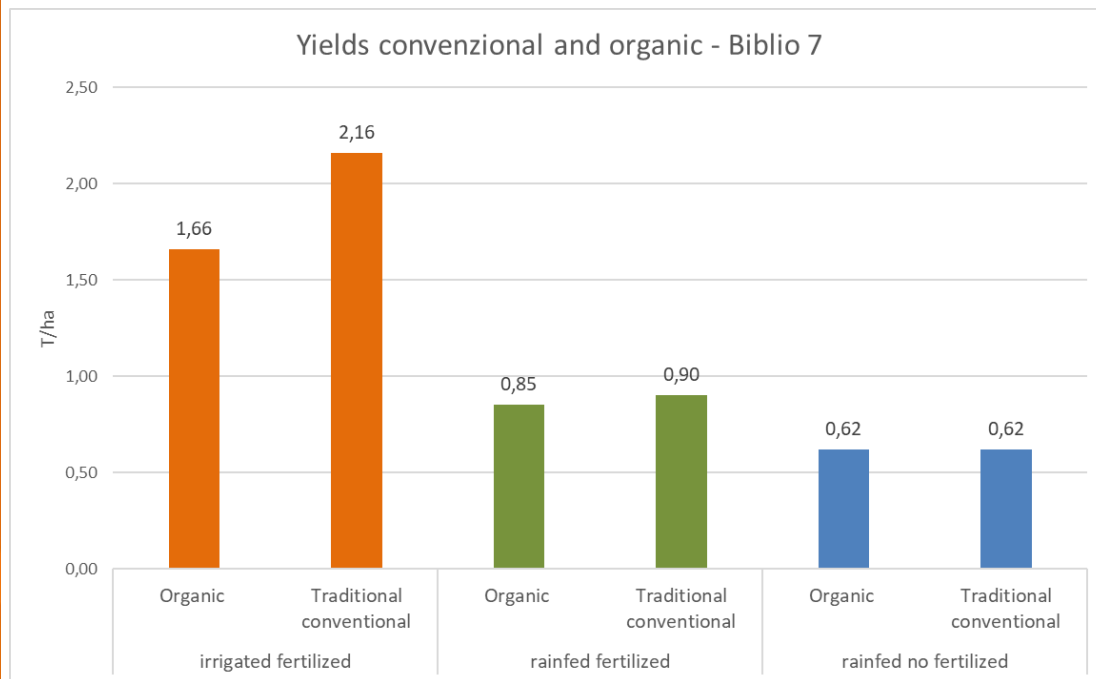
## Yields variability (Faostat – T/ha): 2007-2018

- Average (conv): 4,95
- Min – Max: [3,30 – 6,48]
- Var: 1,35
- Std. Dev.: 1,16
- Growth last 3 years avg on first 3 years avg: 82%





**Tunisia**



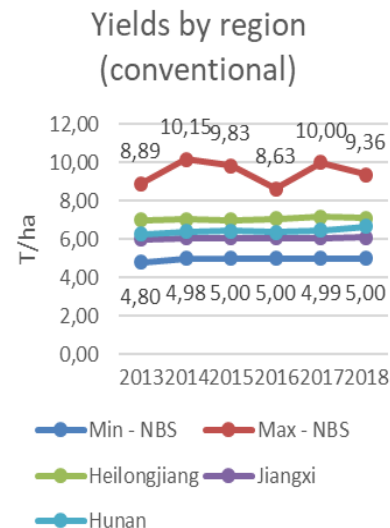
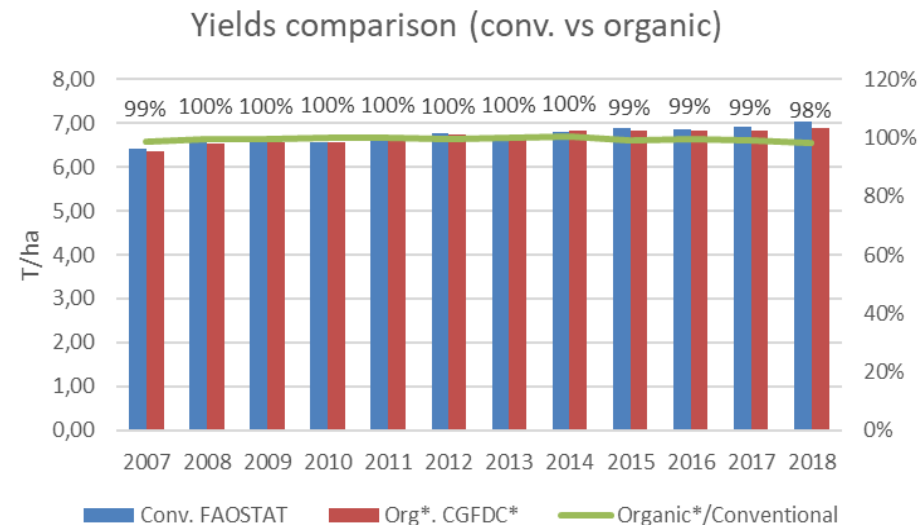
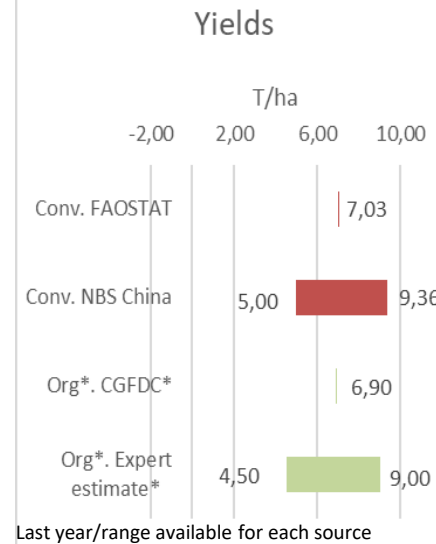
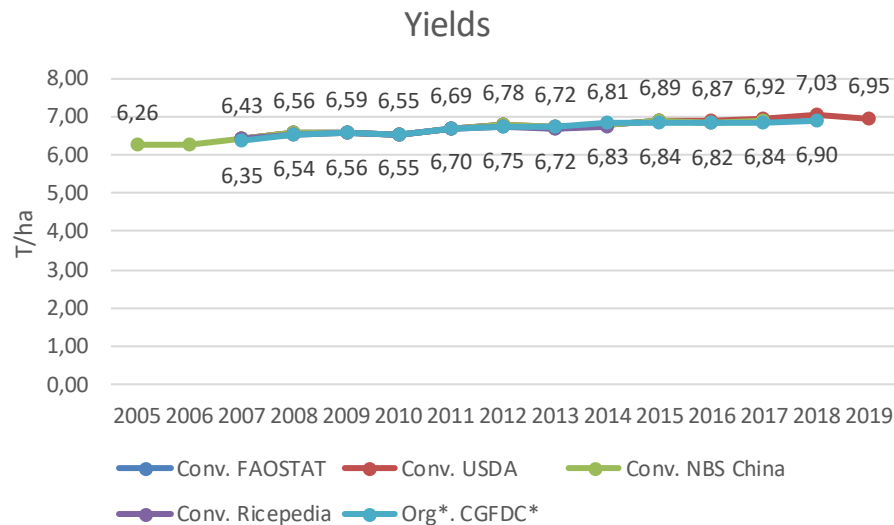
### Main results

- Under the same conditions of irrigation and fertilization, yields of **organic olives** are **slightly lower than conventional ones: between 77% and 100%** depending on the conditions (on avg. 85%).
- Yields of intensive conventional olive groves are higher than yields of traditional conventional and organic groves: yields of traditional conventional groves are 14% of intensive conventional groves; yields of organic groves are 12% of yields of intensive conventional groves.
- High variability of yields: e.g. campaign 2015/2016 20 kg/tree against 38 kg/tree of previous year 2014/2015 (INS). Great variability across different regions (e.g. Médenine region avg. production in 2015/16 is 87 kg/tree)





**China**



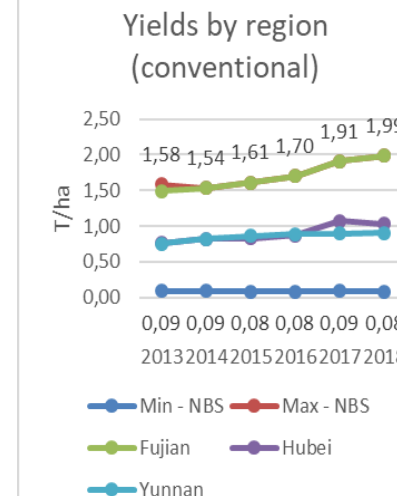
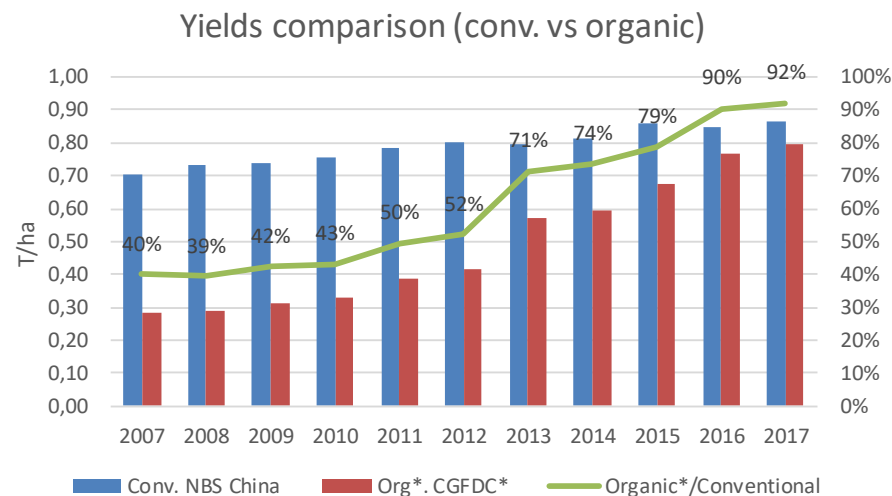
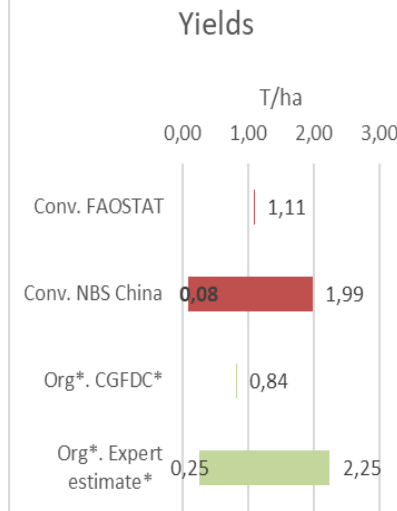
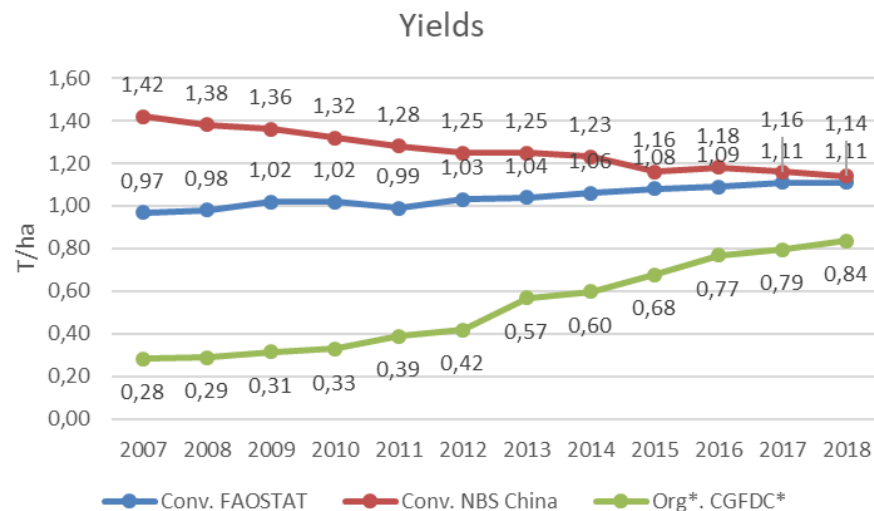
## Main results

- Yields for organic ("green food") and conventional farming are **basically identical**
- Limited growth** over the 2007-19 period and very limited variability, but with high variability depending on the regions (min. 5 T/ha -max. 9,36 T/ha in 2018)
- Interviewed experts however indicated **wider differences in yields across regions** also for organic production [4,50 – 9,00] t/ha
- Three main producing regions with similar yields** in conventional farming

### Yields variability (FAOSTAT – T/ha): 2007-2018

- Average (conv): 6,73
- Min – Max: [6,42 – 7,03]
- Var: 0,03
- Std. Dev.: 0,18
- Growth last 3 years avg on first 3 years avg: 6,3%





## Main results

- Organic yields (“green food”) **lower than conventional ones** but steadily filling the gap over the observed period
- Both conventional and organic yields with **limited variability over time**.
- Organic yields at country level tripled over the 2007-18 period**
- Interviews: **wide differences across regions** for organic production [0,25 – 2,25] t/ha
- Three main producing regions** with rather different conventional yields



### Yields variability (NBS China/CGFDC – T/ha):

#### Conventional 2005-2018

- Average (conv): 0,78
- Min – Max: [0,69 – 0,86]
- Var: 0,00
- Std. Dev.: 0,06

#### Organic 2007-2018

- Average (org.): 0,52
- Min – Max: [0,28 – 0,84]
- Var: 0,04
- Std. Dev.: 0,21

# Synthesis and conclusions



- In most extra-EU countries, **structured and/or reliable data sources on organic farming** are still **completely missing**, making it difficult to assess the correctness and reliability of farmers' declarations about organic products, as well as to elaborate any forecast on organic productions.
- Generally **high variability of yields for both conventional and organic farming**:
  - Among regions (due to latitude, altitude, soil fertility, rainfall, etc.)
  - Over time (mainly due to climate and pests)
  - Among farm typologies (mainly due to differences in cultivation techniques, organisation/management, entrepreneurial attitude towards innovation, etc.)
- In specific conditions, **yields in organic farming may be higher than yields in conventional farming**, mainly due to:
  - Concentration of organic farming in the most efficient, organised and well-managed farms
  - Advanced techniques/varieties in organic farming vs. outdated traditional techniques/varieties in conventional farming
  - Extensive conventional farming vs. intensive organic farming



*Thank you for  
your time!*

**Areté s.r.l.**

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