SUGAR BEET AS A POENTIAL ENERGY CROP IN THE DANUBE REGION

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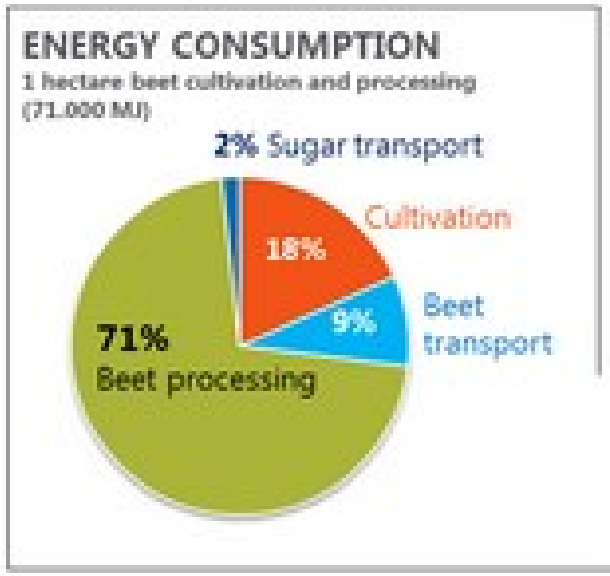
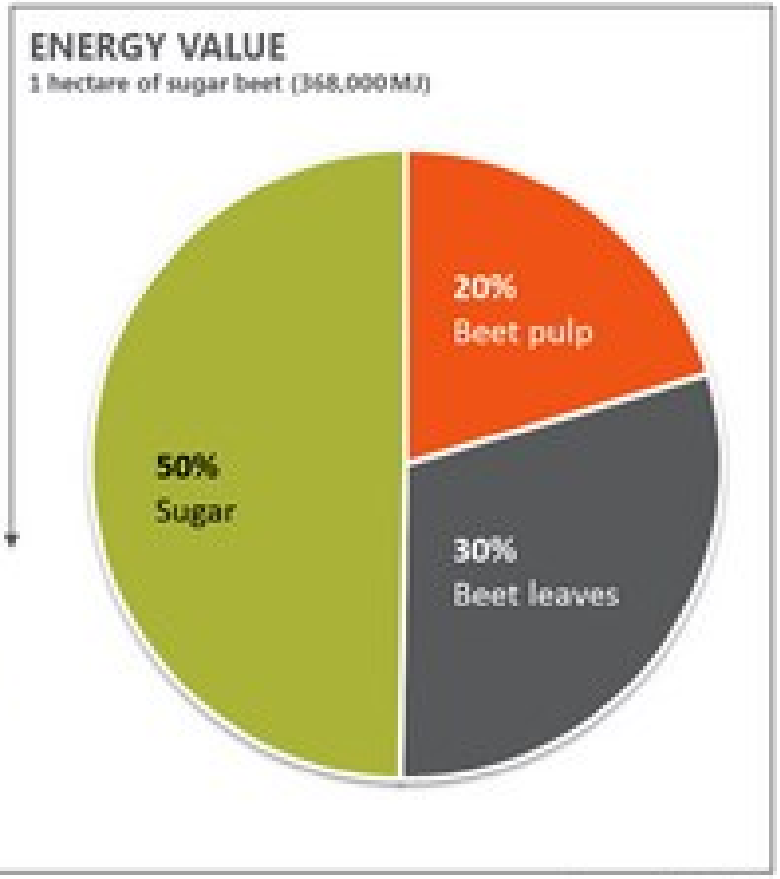
SUGAR BEET IS THE BEST NATURAL *SOLAR PANEL* IN EUROPE (CIBE)





1 unit of energy is used to produce between 2 and 2.5 units of renewable energy

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- Bioenergy potential of EU counties in Danube Region
- Sugar beet production in Danube Region
- Bioenergy production from sugar beet
- Potential and benefits of sugar beet bioethanol production
- Biogas from sugarbeet
- Sugar beet in sustainable agriculture
- Conclusion

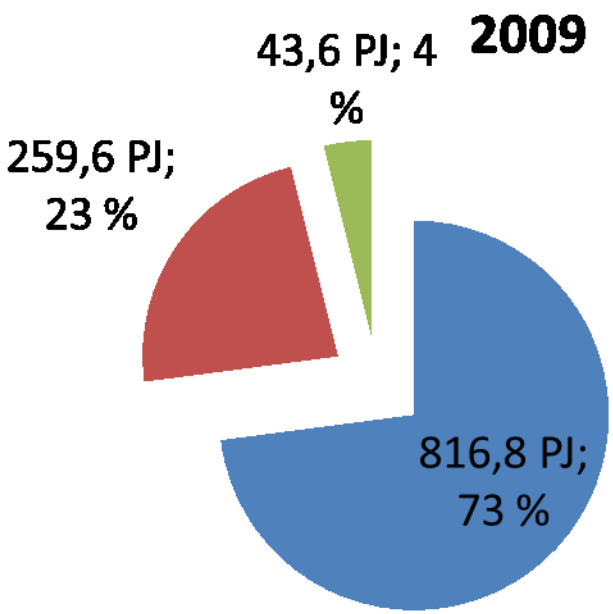
Development of total bioenergy in EU-DC, 2005-2010

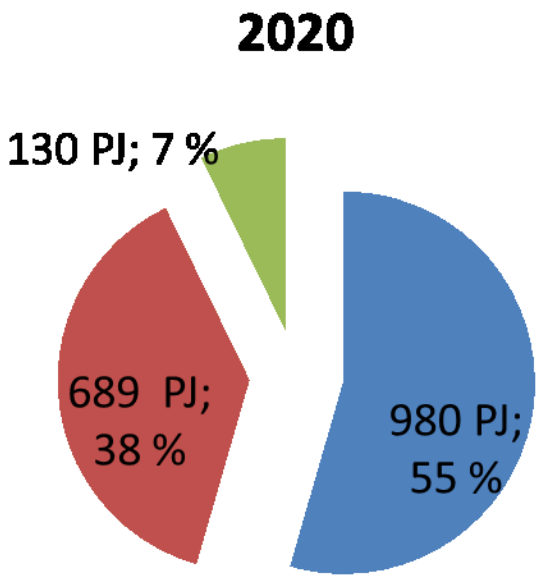
(Soure: *JRC Science and policy report)*

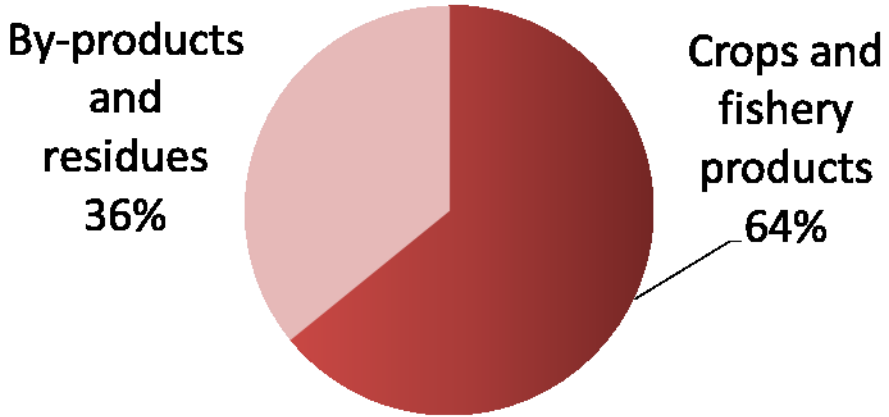
	2005	2010	Growth	
	PJ	PJ	PJ	Annual(%)
Bioheat	702,8	1021,2	318,4	9,1
Bioelectricity	63,8	158	94,2	29,5
Biofuels	82,4	172,6	90,1	21,9
Total bioenergy	**849**	**1351,7**	**502,7**	**11,8**

Main feedstocks of bioenergy in EU-DC

(Soure: *JRC Science and policy report)*







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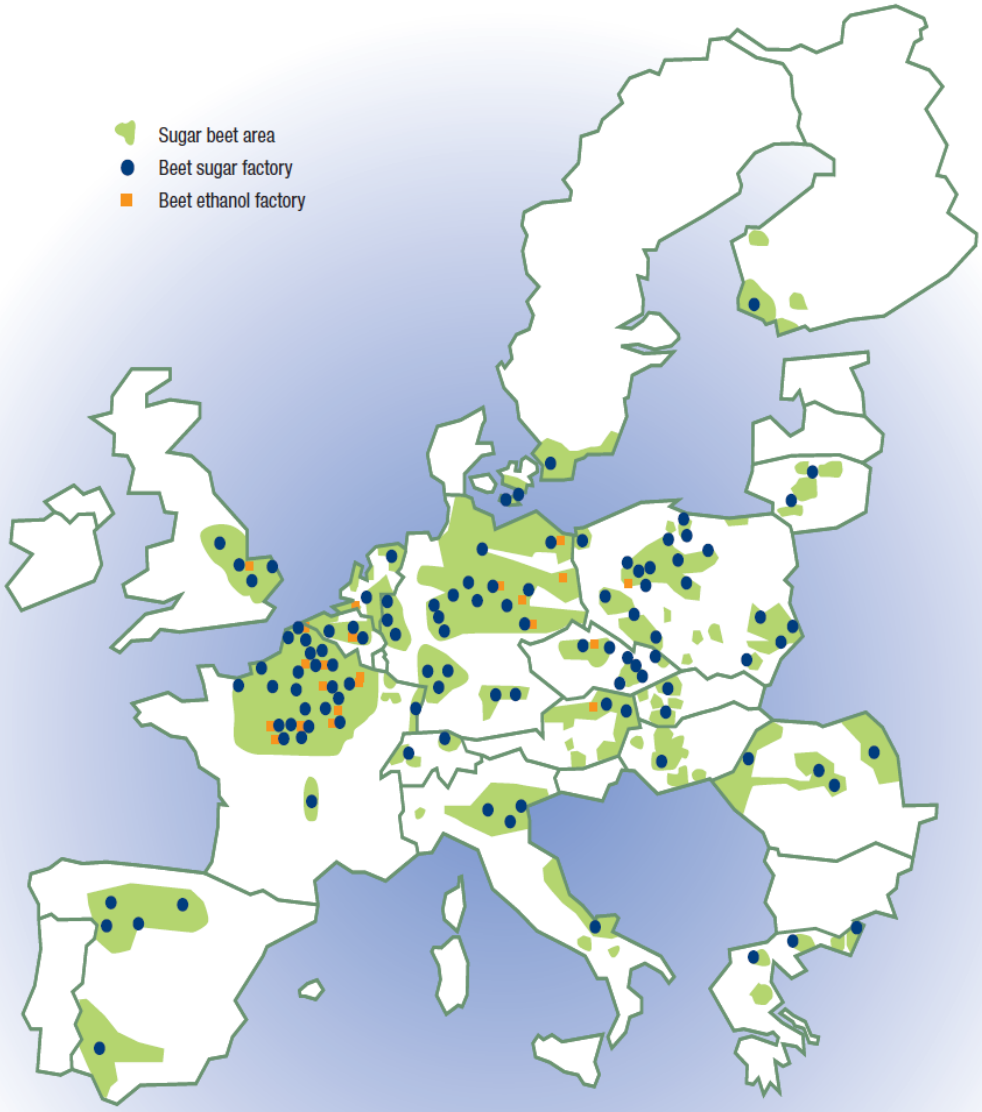


Source: CIBE / CEFS 2009

The main

sugar beet

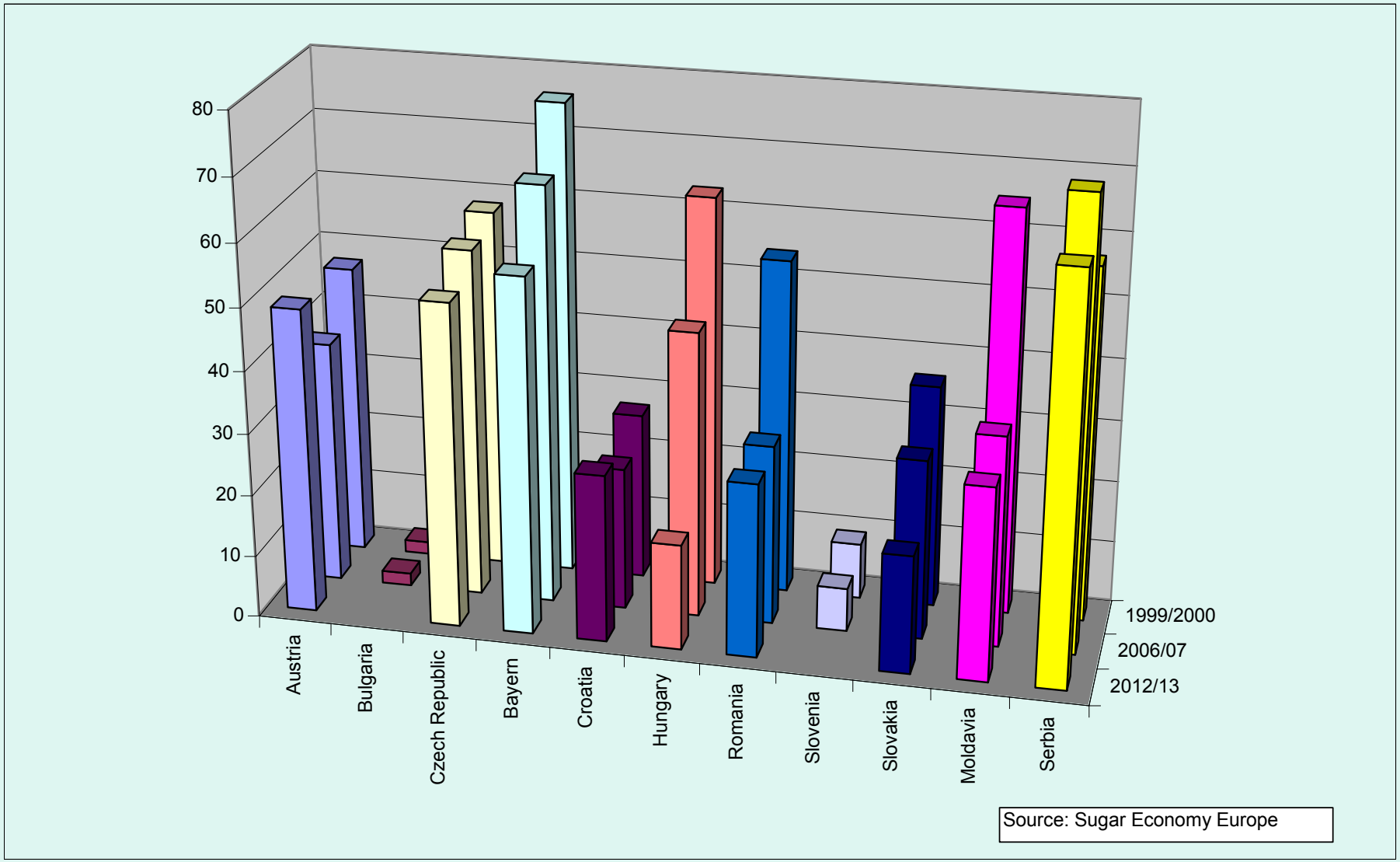
growing areas

and factories

in EU

Countries of Danube River Basin
(Soure: *JRC Science and policy report)*

The changing of sugar beet growing area in Danube Region from 2000



Growing areas of sugar beet during the last 27 years in Danube Region
(Source: Eurostat and Sugar Economy)

Country	Examination period	Max growing area (1000ha)	Growing area 2012/13 (1000ha)
Austria	1987-2014	53,8	49
Bulgaria	1987-2007	41	
Czech Republic	1987-2014	138	52
Bayern	1993-2012	82,6	57
Croatia	2000-2014	34,3	27
Hungary	1987-2014	161	17
Romania	1987-2014	260	28
Slovenia	1991-2006	10,8	
Slovakia	1987-2014	54,7	19
Macedonia	1991-2009	3	
Moldavia	2006-2013	34	31
Serbia	2006-2013	81	65
Total		**900,4**	**345**

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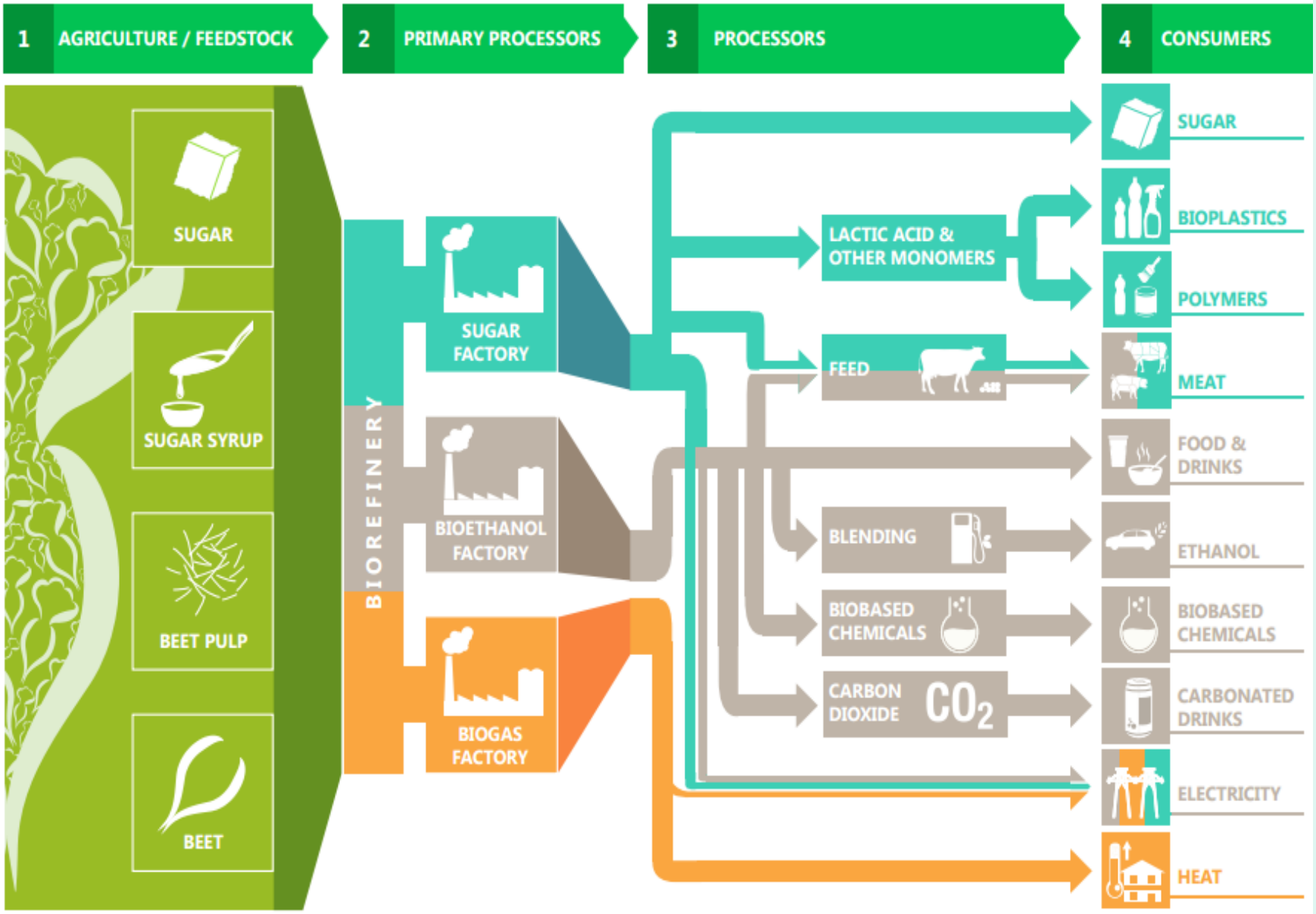
SUGAR BEET IN THE BIOECONOMY VALUE CHAIN



Yearly contribution of sugar beet to the EU Bioeconomy

(Source: CIBE)

- **Around 18 million tonnes of Sugar for food consumption**
- **Around 1.6 million tonnes of Sugar Syrups for Ethanol production**
- **Around 0.8 million tonnes of Sugar Syrups for Chemical Industry**
- **Around 20-40,000 hectares of sugar beet are converted yearly into biogas for heat and electricity**
- **Close to 5 million tonnes of beet pulp (dry matter equivalent) for feed**

Bioenergy from sugar beet

1. year

Root – Leaves (2,3 – 1)

Bioethanol

1. és 2. Generation

Biogas

Burning (beet pulp)

2. year

Seed production

2. Generation

Bioethanol

Biogas

Burning (seed stalk)

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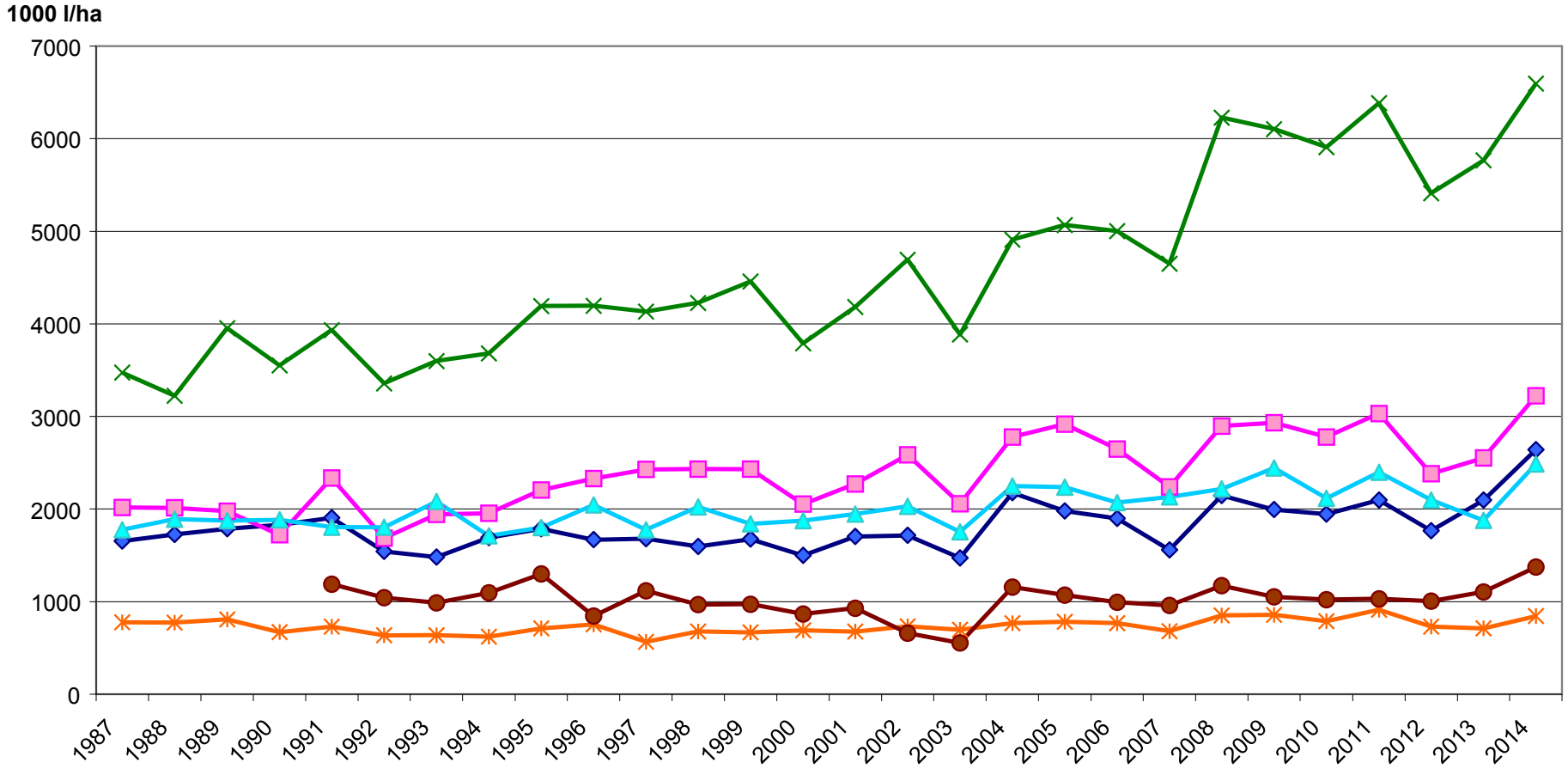
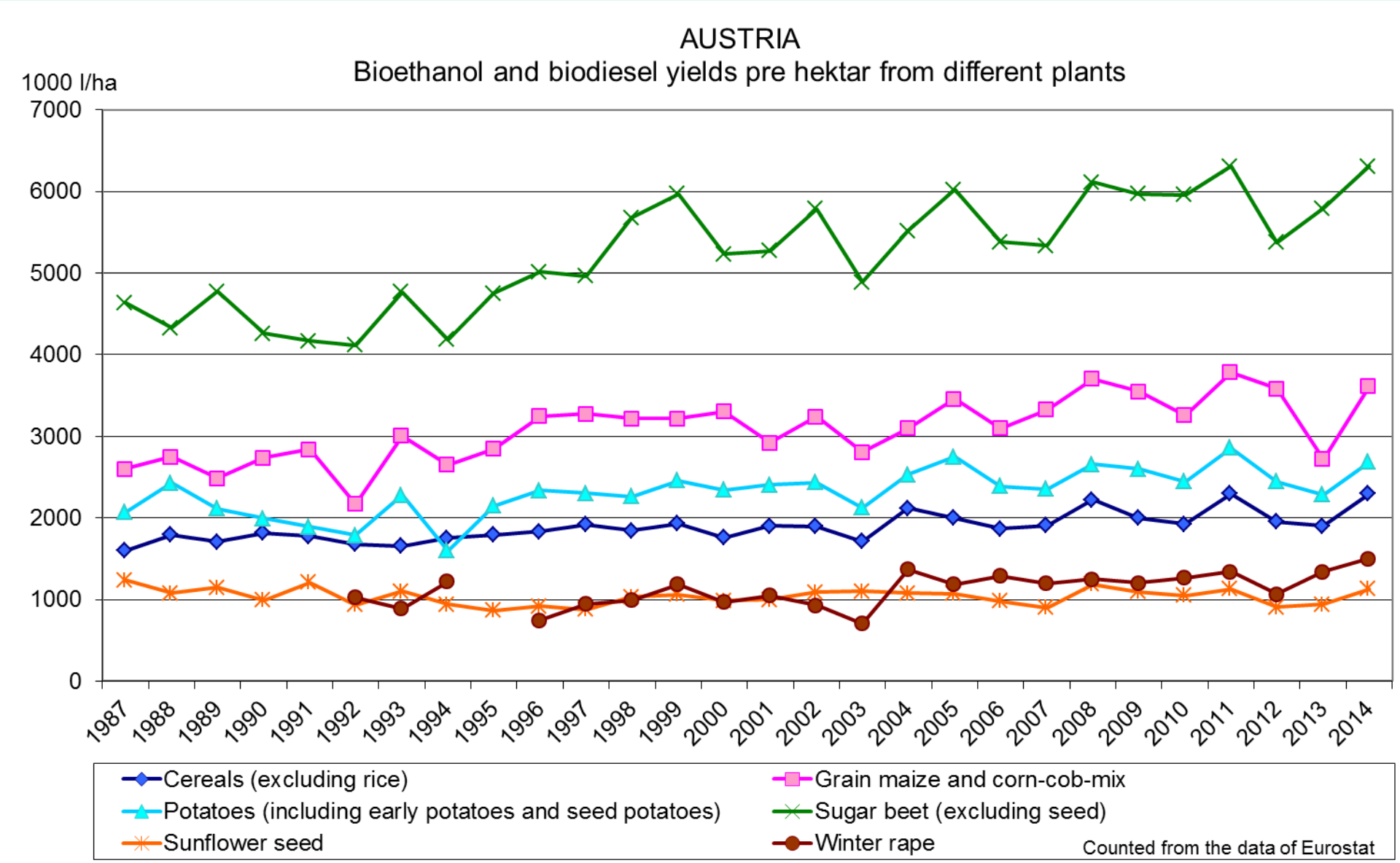
The potential bioethanol and biodiesel yield of different plants in Danube Region countries from 1987 to2014.

Counted from averages national yield data of Eurostat

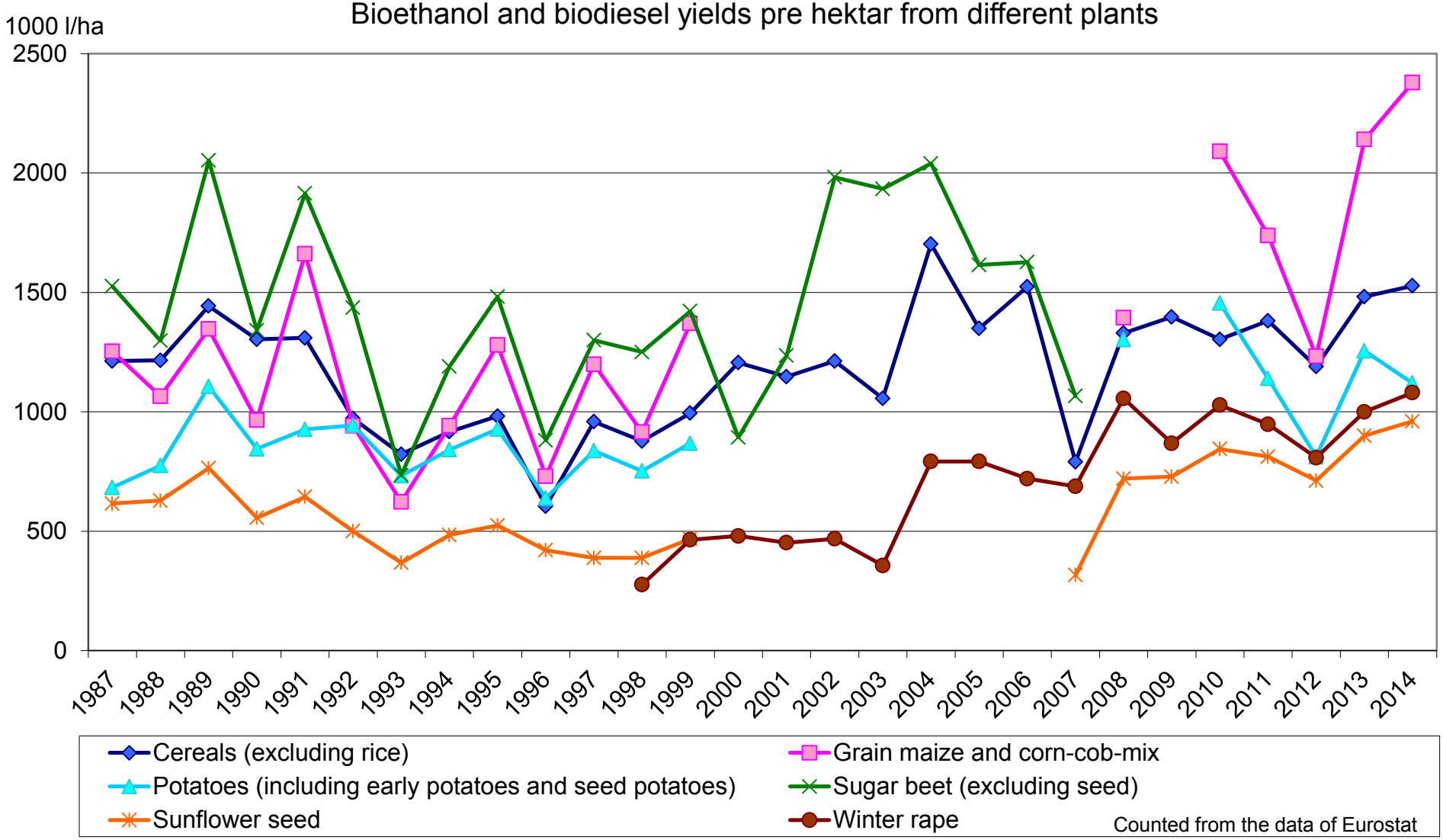


Counted from the data of Eurostat

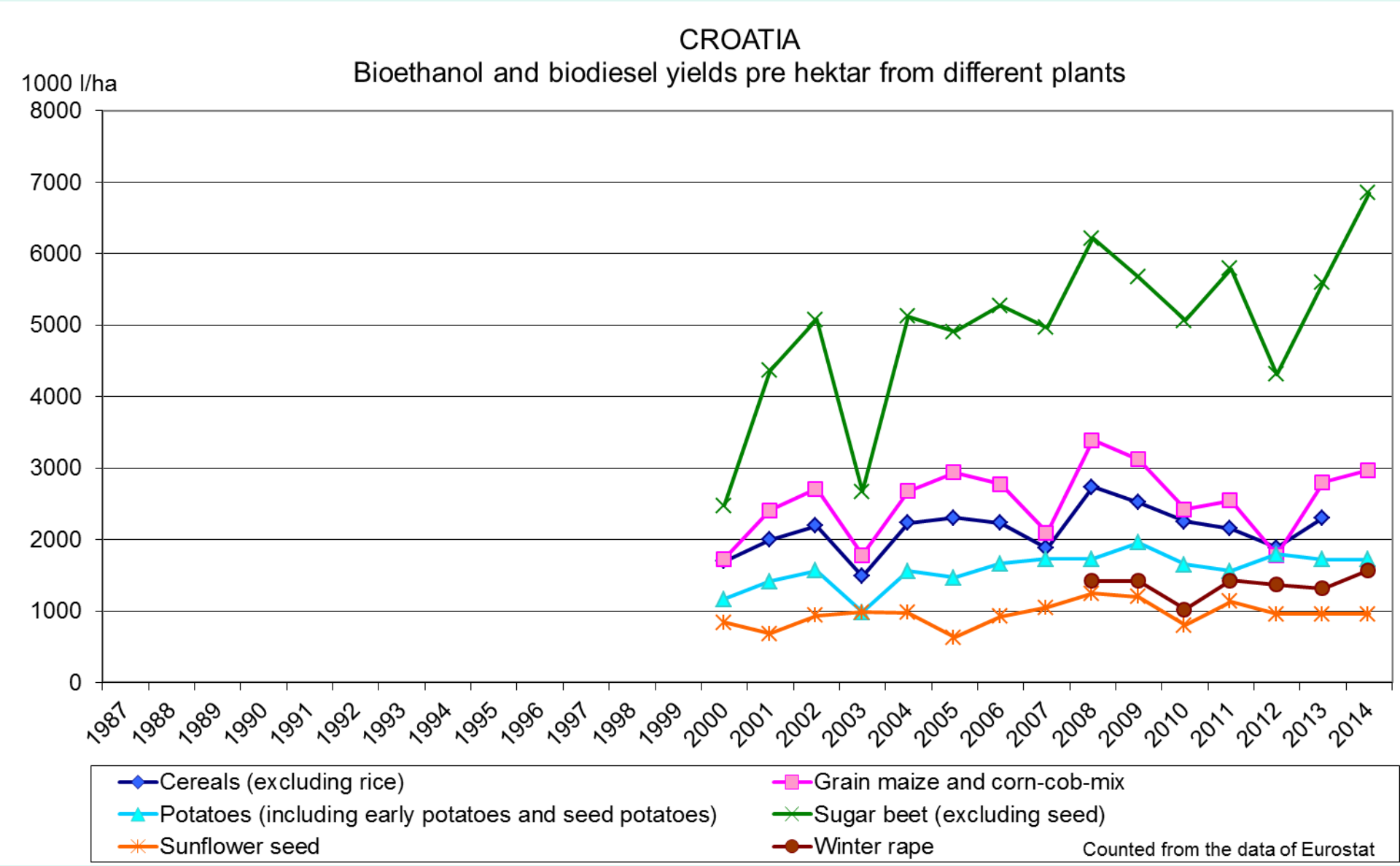

AUSTRIA
Bioethanol and biodiesel yields pre hektar from different plants
1000 l/ha
7000
6000
5000
4000
3000
2000
1000
0
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Cereals (excluding rice)
Grain maize and corn-cob-mix
Potatoes (including early potatoes and seed potatoes)
Sugar beet (excluding seed)
Sunflower seed
Winter rape
Counted from the data of Eurostat

BULGARIA

Bioethanol and biodiesel yields pre hektar from different plants



Counted from the data of Eurostat


CROATIA
Bioethanol and biodiesel yields pre hektar from different plants
1000 l/ha
8000
7000
6000
5000
4000
3000
2000
1000
0
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
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2001
2002
2003
2004
2005
2006
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2012
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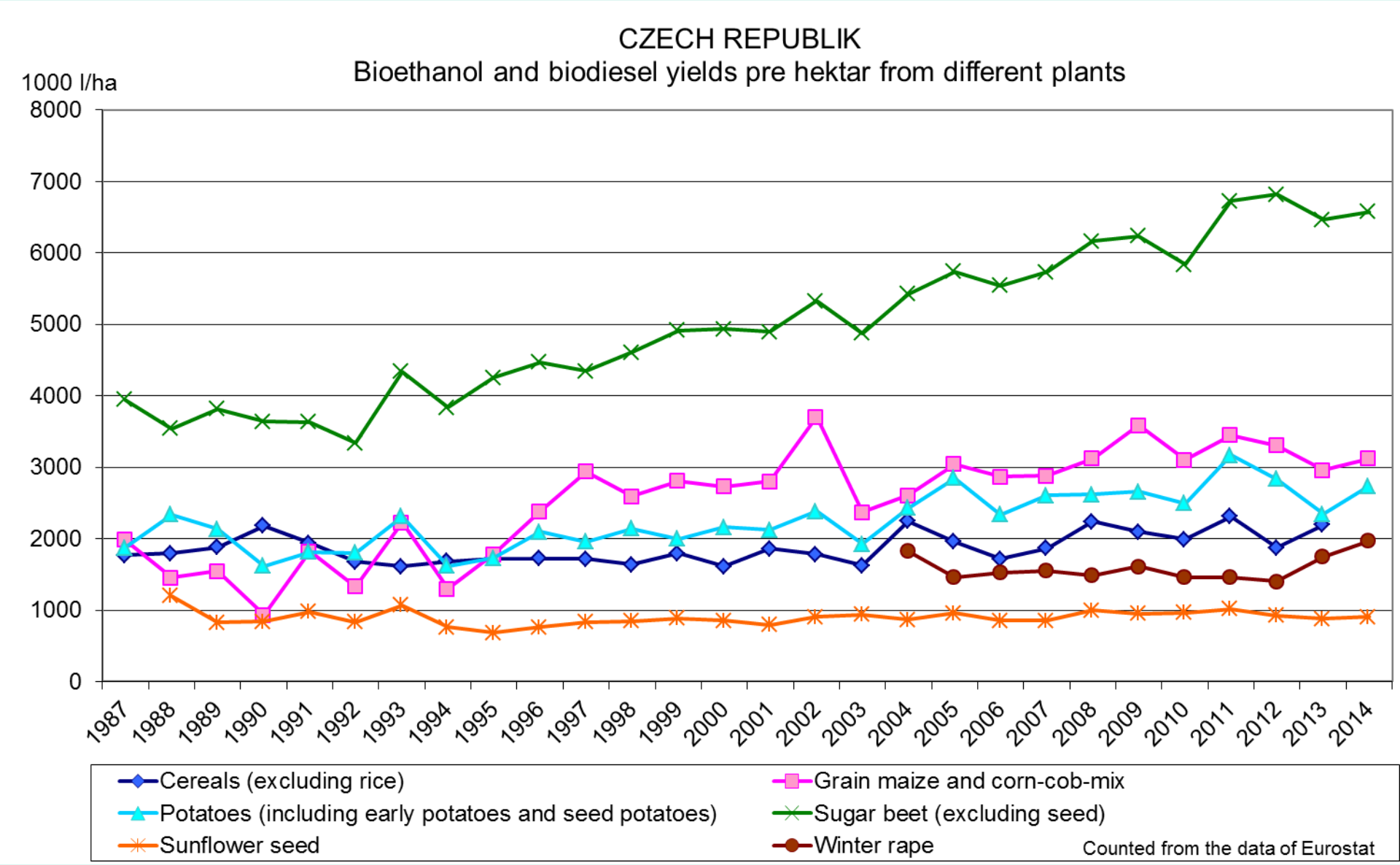
CZECH REPUBLIK
Bioethanol and biodiesel yields pre hektar from different plants
1000 l/ha
8000
7000
6000
5000
4000
3000
2000
1000
0
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
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2004
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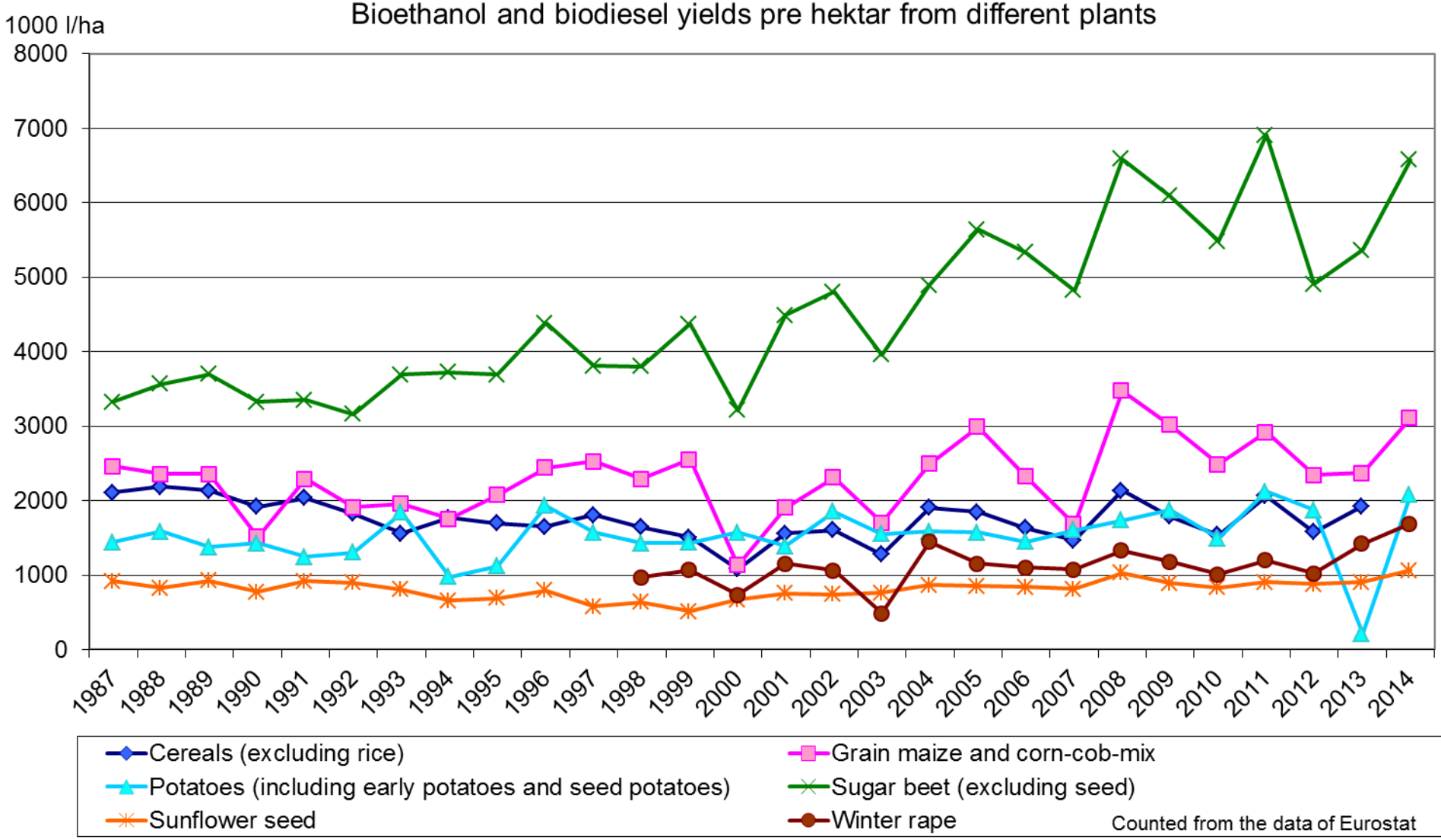
2010
2011
2012
2013
2014
Cereals (excluding rice)
Grain maize and corn-cob-mix
Potatoes (including early potatoes and seed potatoes)
Sugar beet (excluding seed)
Sunflower seed
Winter rape
Counted from the data of Eurostat

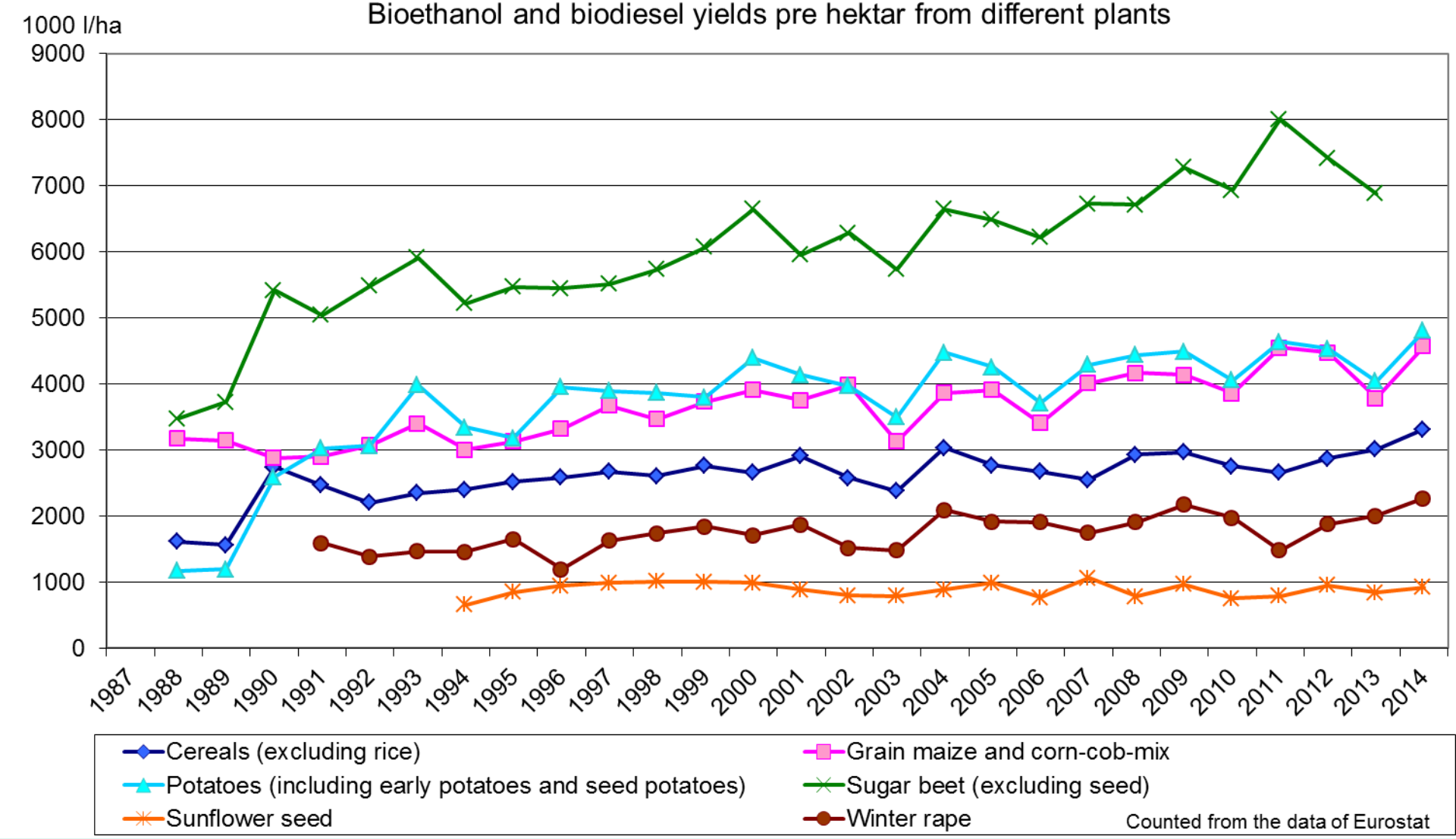
SLOVAKIA

Bioethanol and biodiesel yields pre hektar from different plants



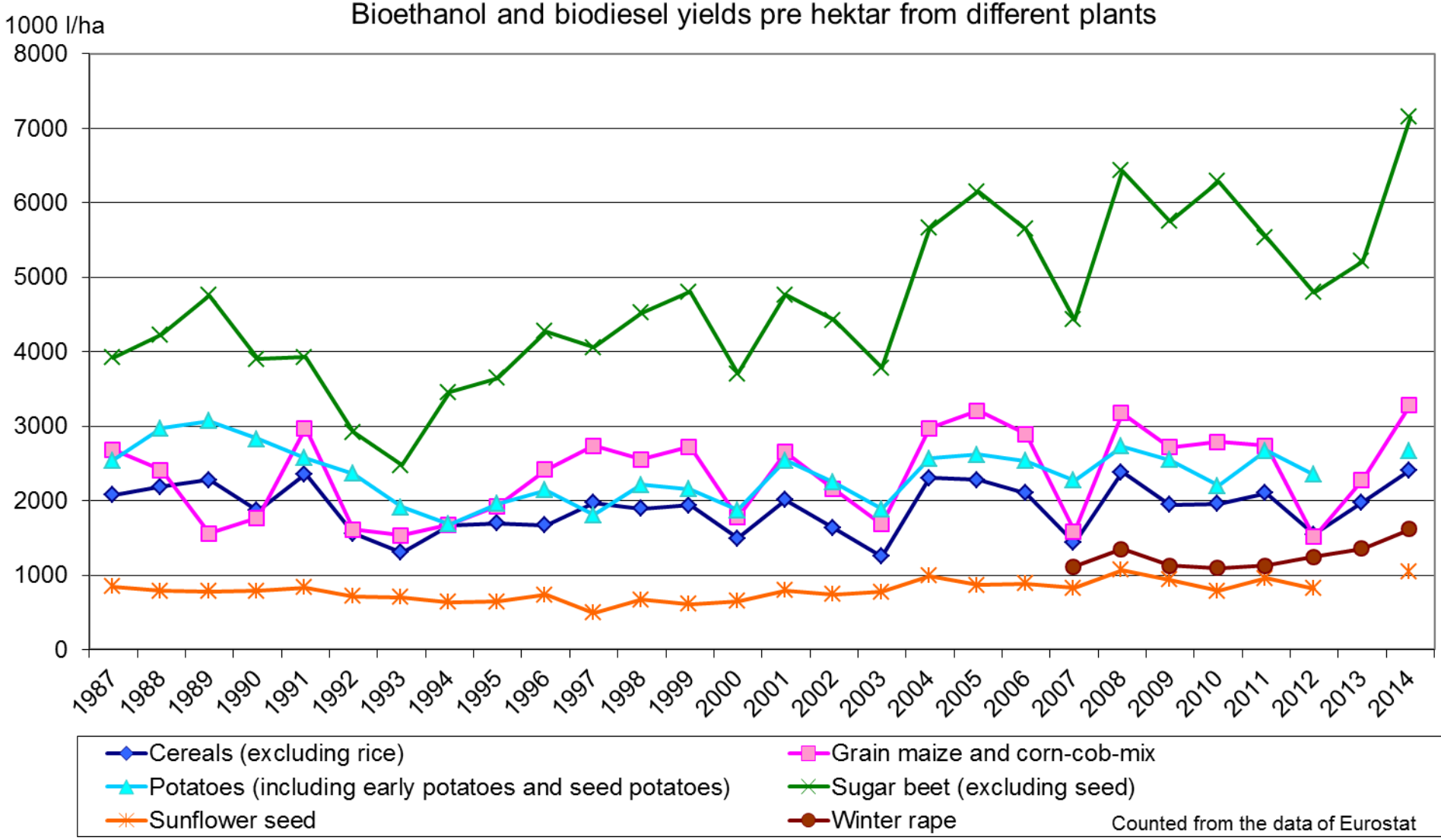
GERMANY

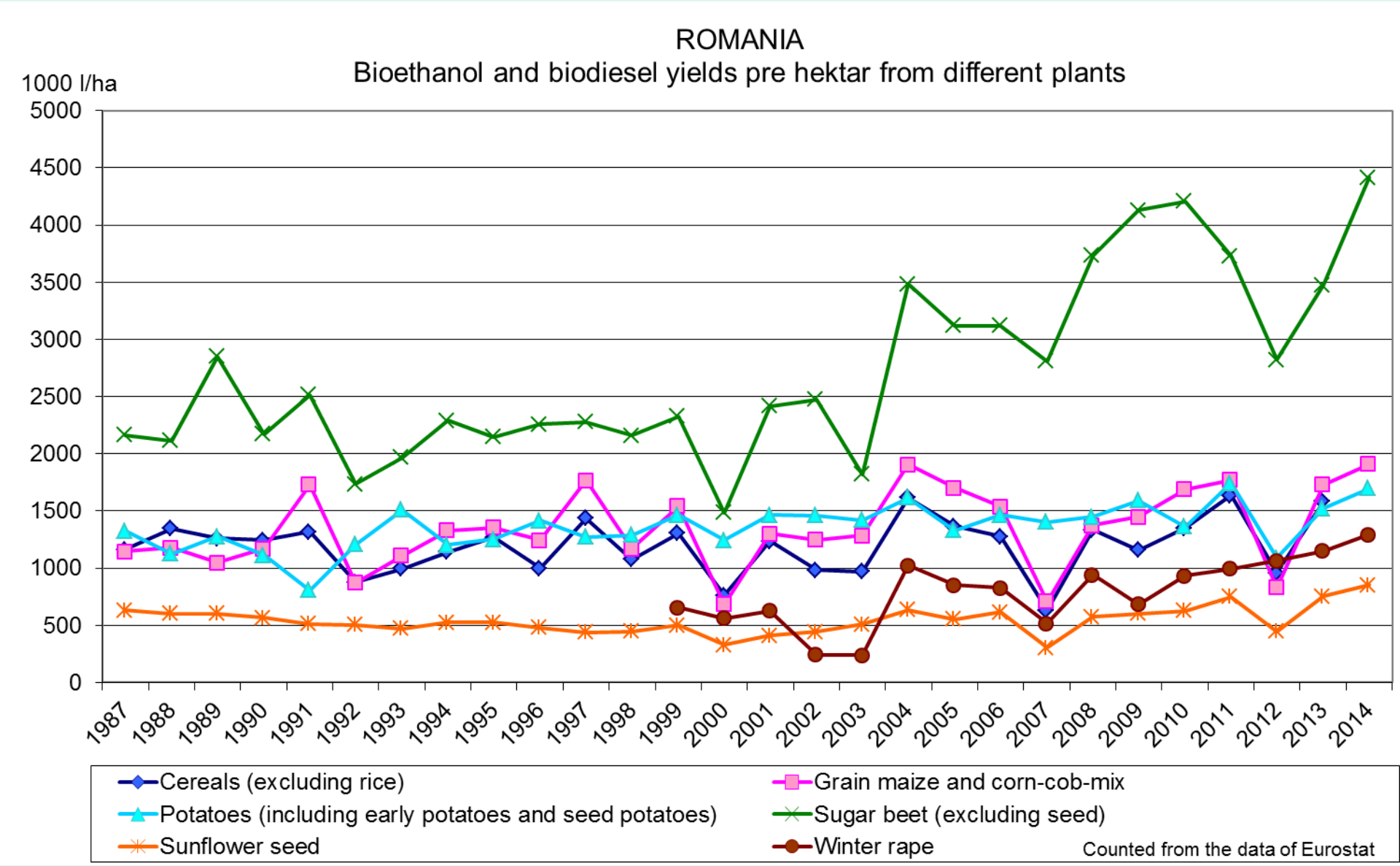
Bioethanol and biodiesel yields pre hektar from different plants



HUNGARY

Bioethanol and biodiesel yields pre hektar from different plants




ROMANIA
Bioethanol and biodiesel yields pre hektar from different plants
1000 l/ha
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
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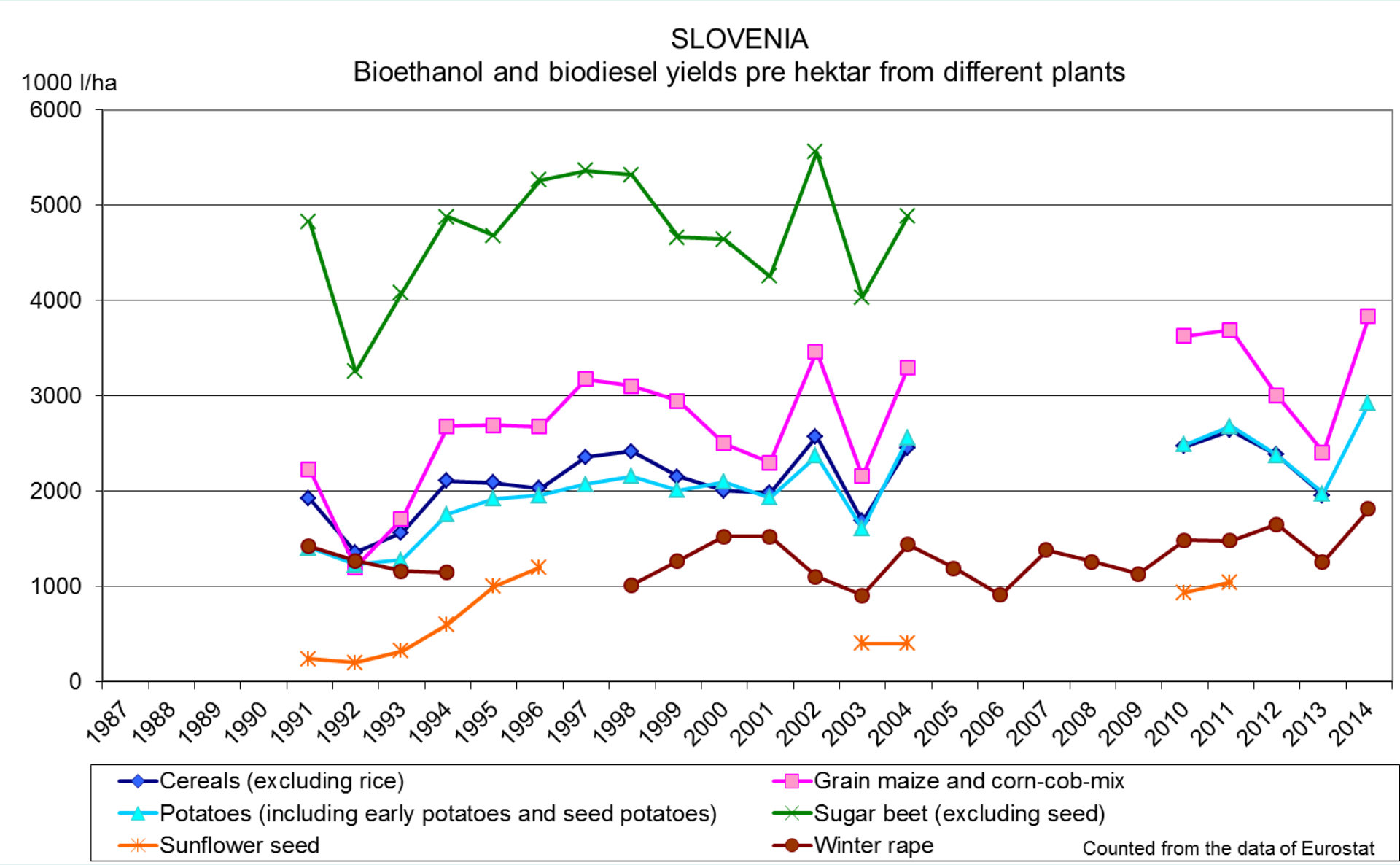
SLOVENIA
Bioethanol and biodiesel yields pre hektar from different plants
1000 l/ha
6000
5000
4000
3000
2000
1000
0
1987
1988
1989
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1992
1993
1994
1995
1996
1997
1998
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BIOETHANOL: OUTPUT PER HECTAR

Feedstock	Kilometers per hectare	Share of yearly protein ration per cow
Sugar Beet	80,300 km	+ 74%

co-produces vinasse in a quantity which, based on its useful protein content, corresponds to the soy meal produced from over 0.73 hectares of soybean.

co-produces pulp in a quantity which, based on its metabolic energy, corresponds to the fodder barley produced on over 0.6 hectares (source: Crop Energies)

Sugar Cane	77,500 km	+ 0%

Source: BDBe - ePure

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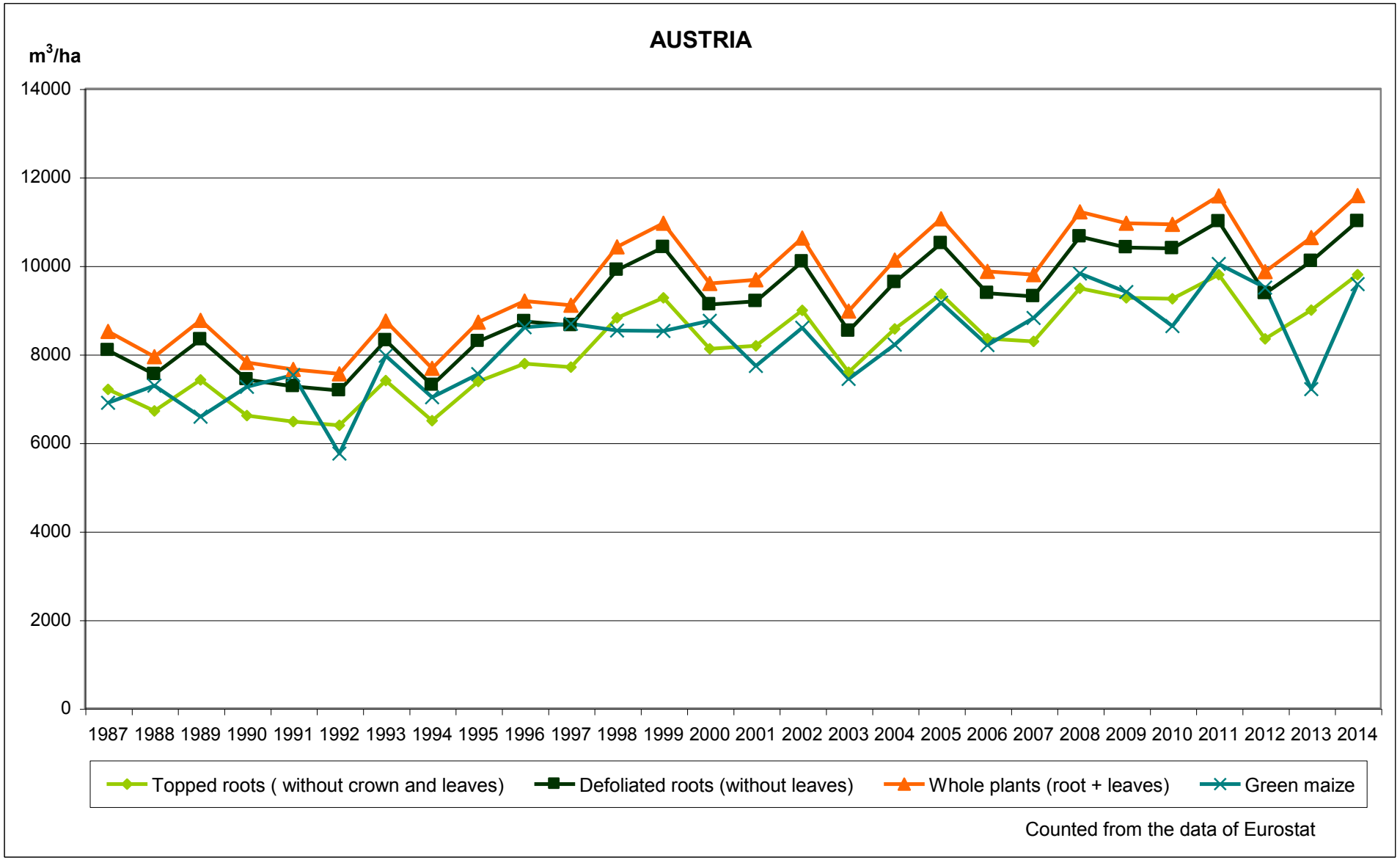
The potential of biogas from sugarbeet and green maise in Danube Region countries from 1987 to2014
Counted from averages national yield data of Eurostat.

The potential of biogas from sugarbeet and green maise in Austria from 1987 to2014
Counted from averages national yield data of Eurostat.



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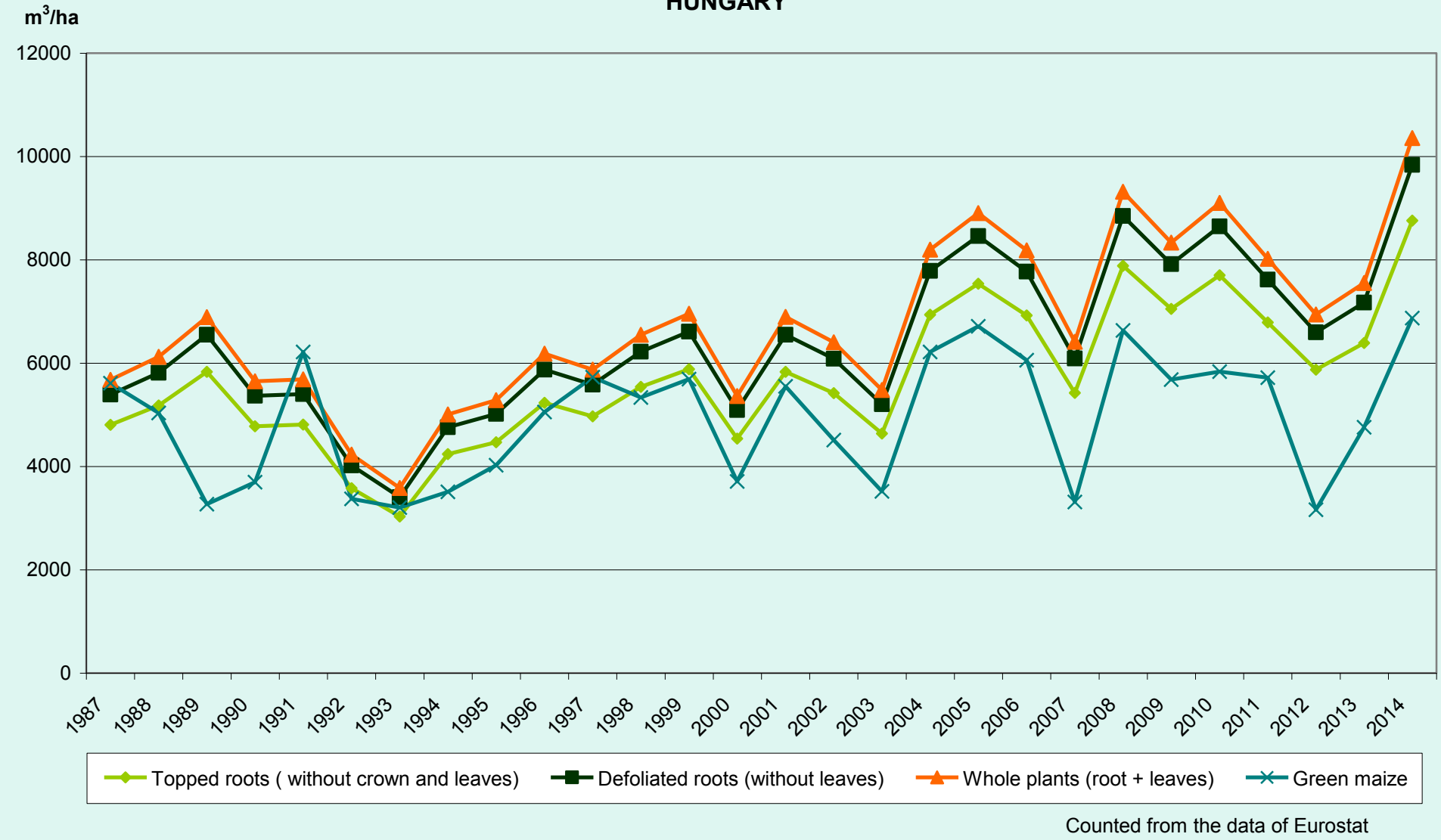

Counted from the data of Eurostat

The potential biogas yields of sugar beet in Danube Region. Counted from the data of Eurostat

Raw material for biogas	From 1991	From 2001	From 2011
	Average biogas yield m^3/ha		
Average sugar beet yield (t/ha)	44	51	56
Topped roots (without crown and leaves)	5838	6559	7399
Defoliated roots (without leaves)	6554	7362	8307
Whole plants (root + leaves)	6899	7749	8744

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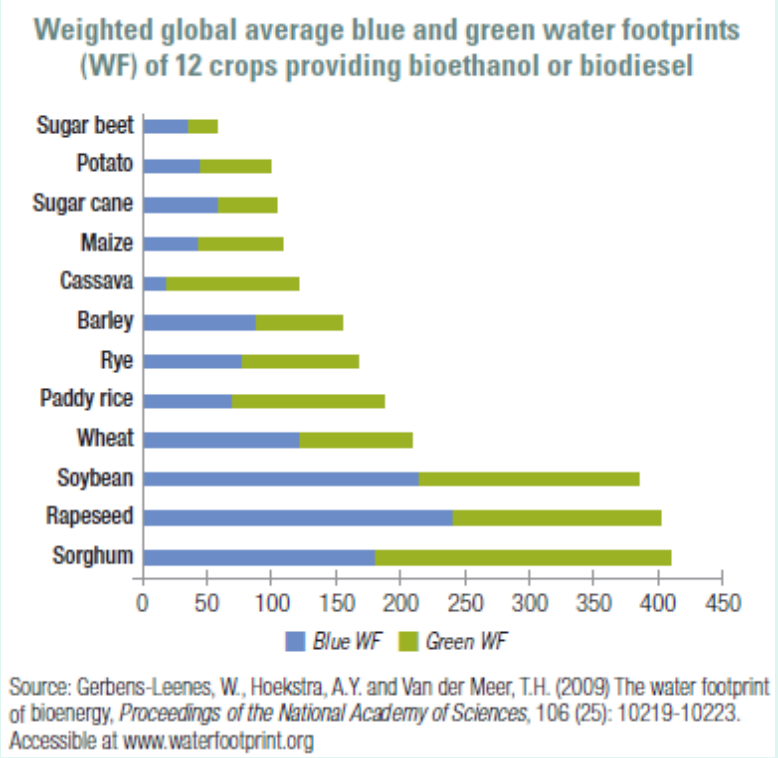
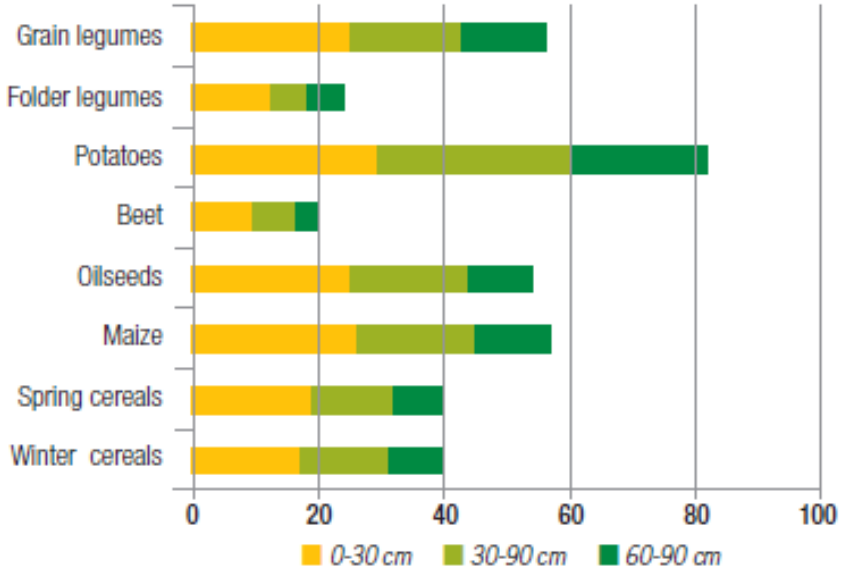
Environmental benefits of sugar beet growing

- ✓ enhances soil fertility
- ✓ improves soil structure and water-holding capacity
- ✓ reduces soil acidity
- ✓ helps to avoid soil erosion, and soil tare
- ✓ captures N and other nutrients efficiently, thus preventing ground water pollution
- ✓ helps to maintaine the flora and fauna biodiversity
- ✓ reduces weed propagation, damages caused by diseases and pests, consequently, pesticides demand decreases
- ✓ reduces net GHG emission

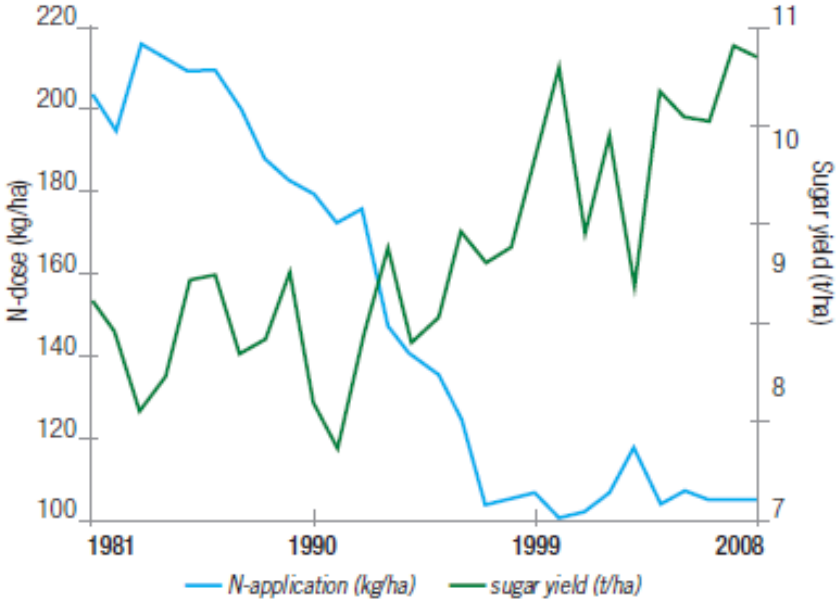


Evolution of nitrate residue in soil after sugar beet in water protection areas of Baden-Württemberg, Germany



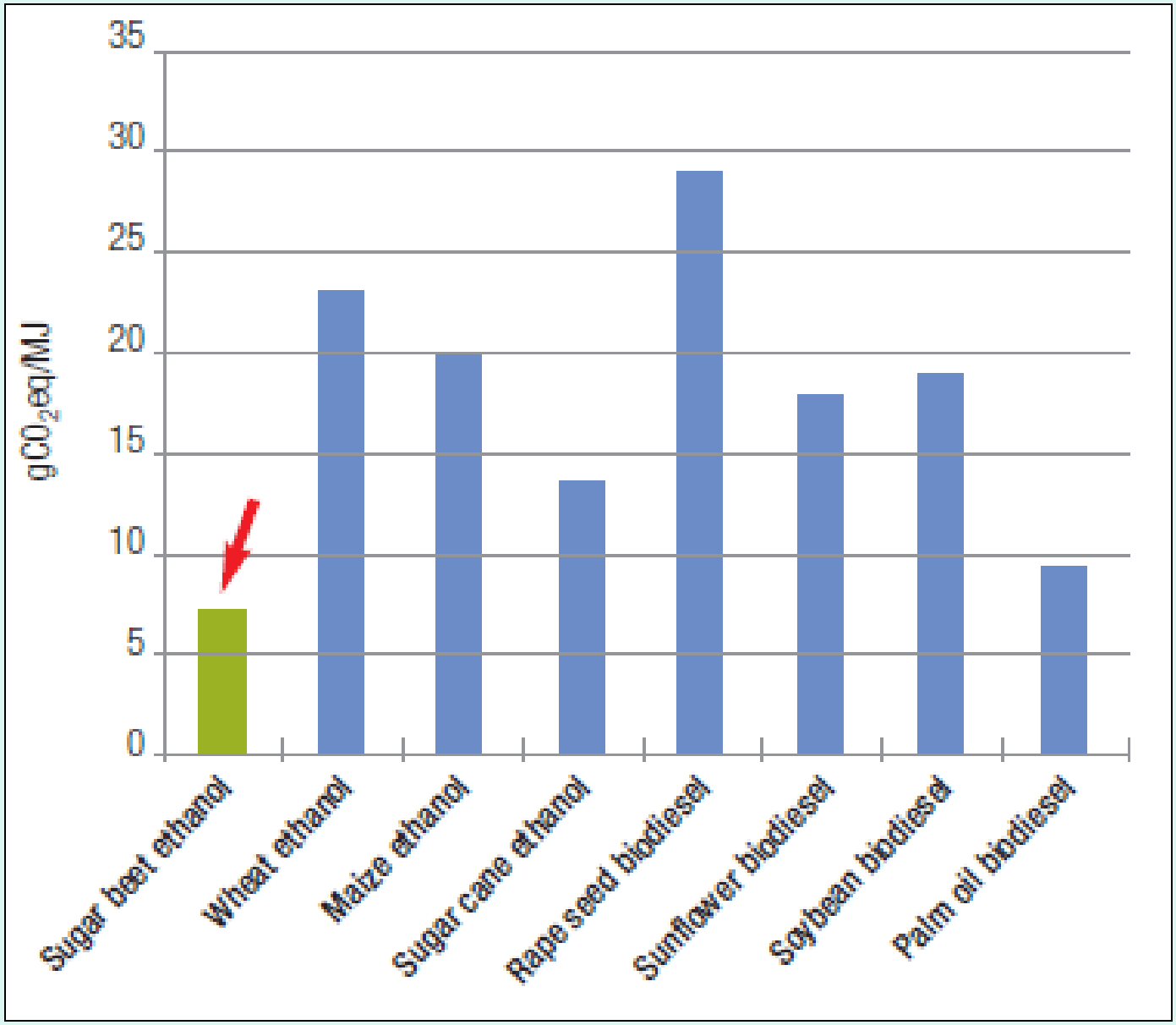
Source: Agricultural Technology Center (LTZ), Augustenberg, Germany

Evolution of N fertiliser application and sugar yield in sugar beet growing regions of southern Germany



Source: South German Sugar Beet Growers' Association (VSZ), Germany

GHG emission of different energy crops.



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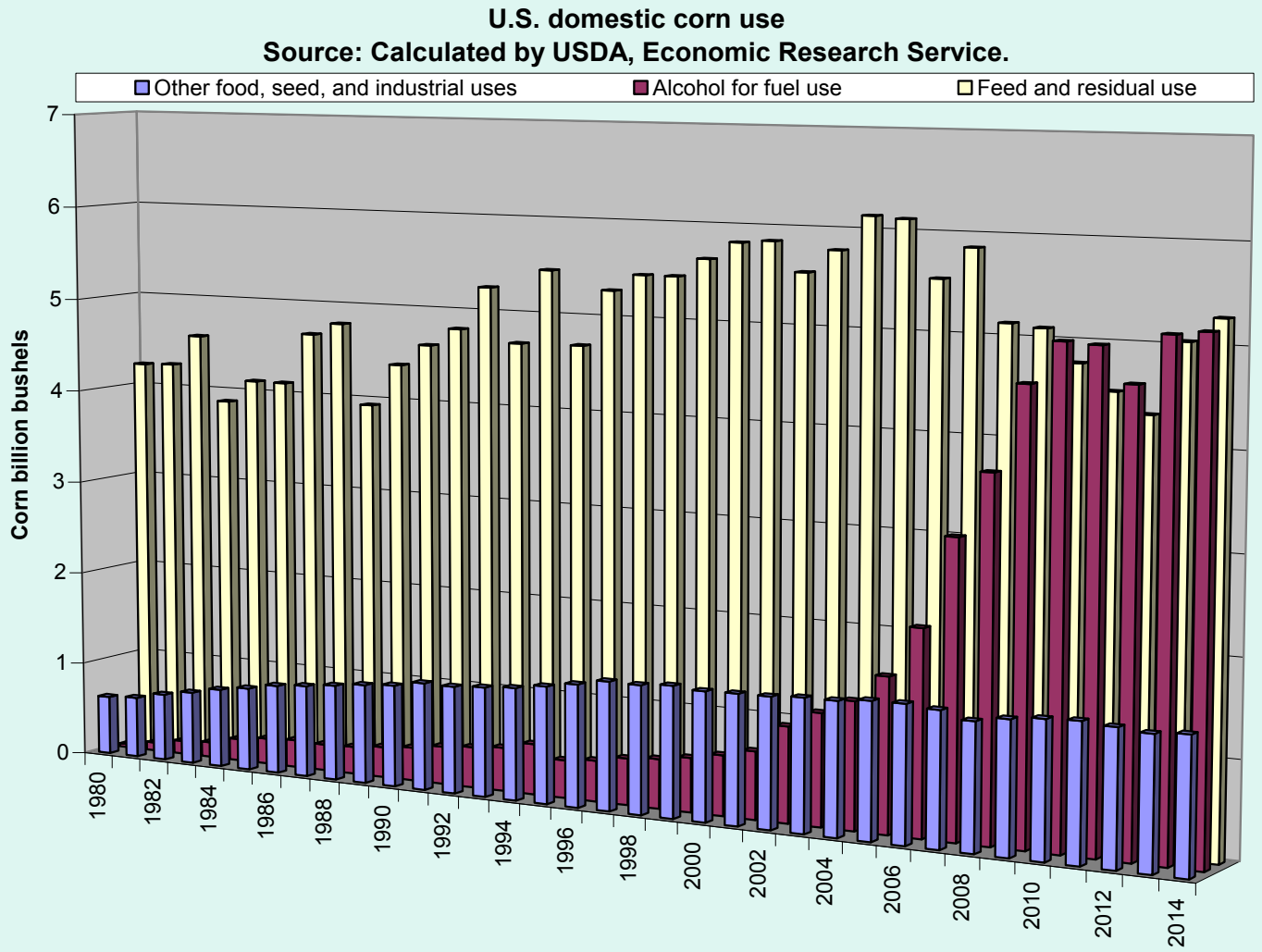

In Danube Region sugar beet can yield average about twice the amount of bioethanol per hectare than corn and three times than wheat.

The potential bioethanol yields in Danube Region. Counted from the data of Eurostat

	From 1991	From 2001	From 2011
Average sugar beet yield (t/ha)	44	51	56
Average bioethanol yield (l/ha)	4765	5356	6039
Average biogas yield (m3/ha)	2200	2550	2800
Bioethanol and biogas production	1,67	1,87	2,11
in 350.000 ha (million m^3)	770	893	980
+ Soybean field (1000ha)	256	287	323
Total energy production (million MJ)	52,177	59,103	66,081

In addition to ethanol production, other components of the sugar beet plant and residues of sugar/ethanol prodction can be used advantageously for biochemicals and/or biogas production.


Thank you for attention!