The impact of fertilizer used in leaf tree plantations on heavy metal content in birch bolete (leccinum scabrum)

Kristīne Zadvinska[1], Lauma Buša[1], Arturs Vīksna[1], Kristaps Makovskis[2], Kārlis Dūmiņš[2]

[1]Faculty of Chemistry, University of Latvia, Jelgavas Street 1, Riga, LV-1004, Latvia

[2]Latvian State Forest Research Institute "Silava", RigasStreet 111, Salaspils, LV-2169, Latvia

E-mail: kristine.zadvinska@gmail.com

Introduction

Aspens are becoming more popular as an agricultural crop

Use of byproducts of industrial processes as fertilizers – digestate, wood ash, wastewater sludge

Research object

Experimental plot of aspen hybrids

Populus tremula x tremuloides

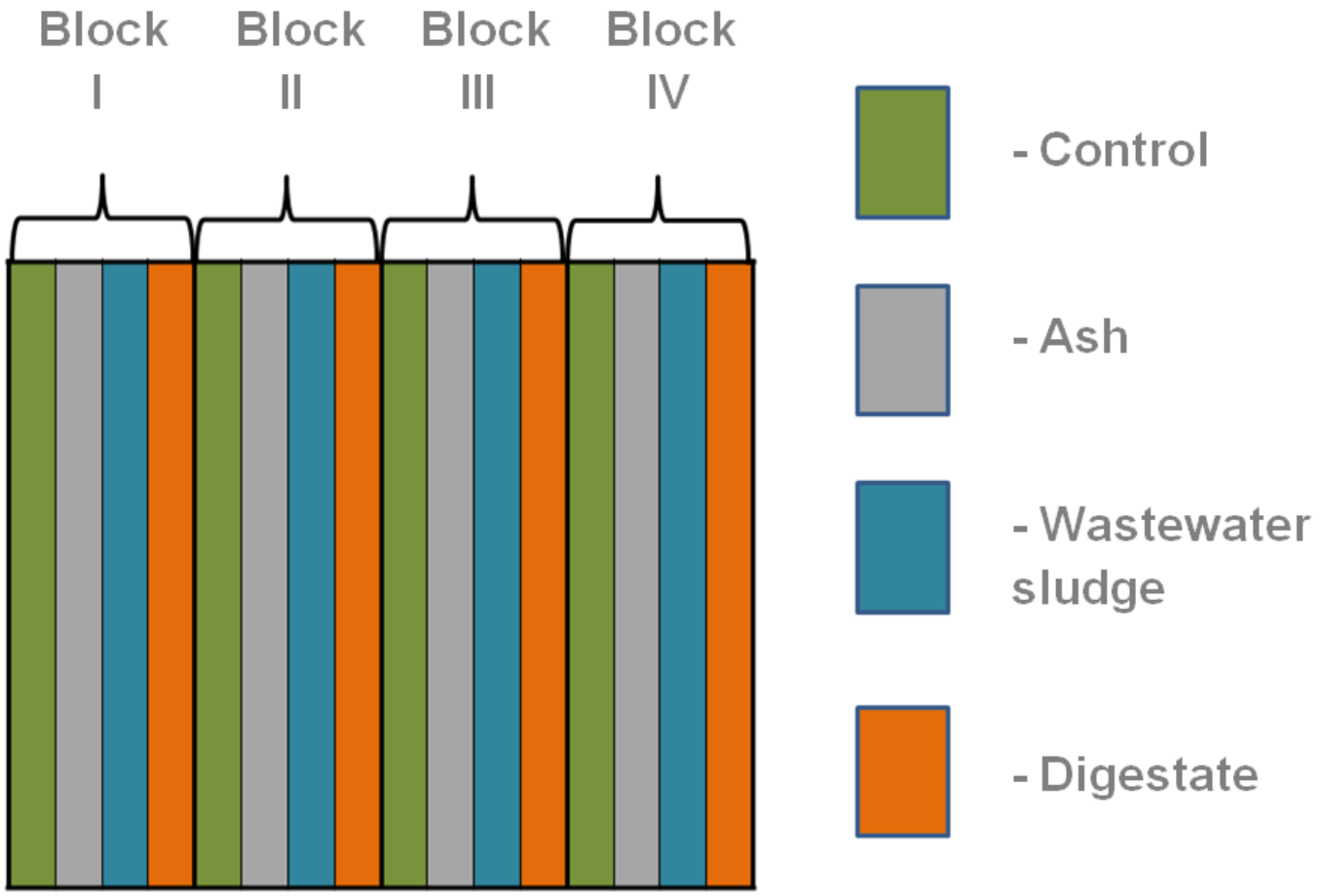
LVMI “Silava”

Skrīveri

Spring 2011

Research object

Samples – soil and boletus mushrooms



Methods

Boletes

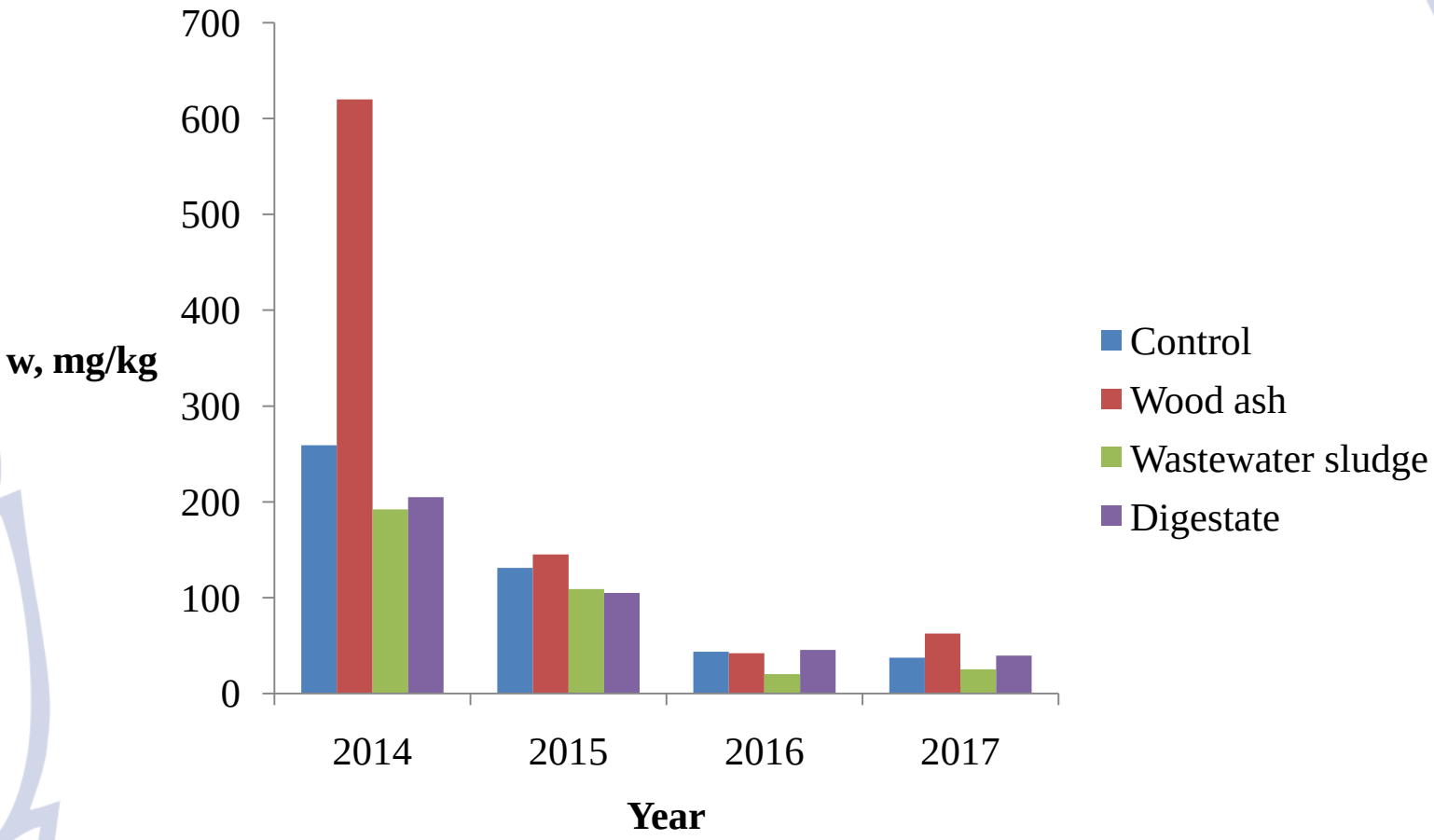
- Dry ashing, Microwave digestion
- ICP-MS, FAAS
- IRMS

Soil

- Extraction with 0,1M HNO_3
- TXRF

Results

Ca content in aspen boletes



Results

Content of select elements in the fertilizers

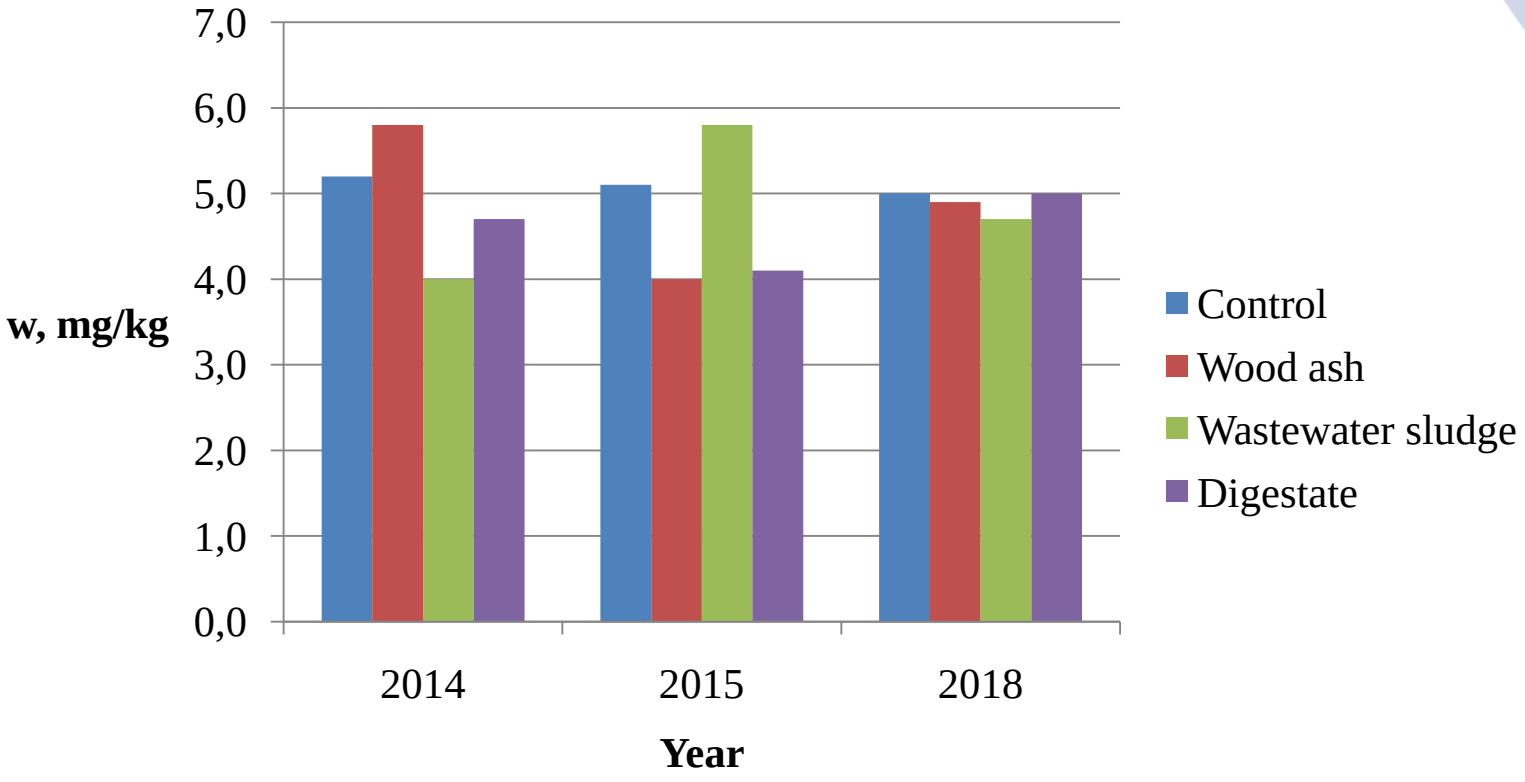
Fertilizer	Ca, g/kg	Mg, g/kg	Mn, g/kg
Wood ash	224,8	30,9	3,1
Wastewater sludge	10,9	11,3	0,3

pH values of the fertilizers

Fertilizer	pH(KCl)	pH(H_2O)	pH($CaCl_2$)
Wood ash	11,6	12,1	11,8
Wastewater sludge	6,2	6,2	6,0

Results

Mn content in boletes



Results

pH values of the soil in 2012

Fertilizer	Block I	Block II
Control	7,8	7,7
Wood Ash	7,7	8,1
Wastewater sludge	7,9	8,0

Bardule, A.; Rancane, S.; Gutmane, I.; Berzins, P.; Stesele, V.; Lazdina, D.; Bardulis, A. The effect of fertiliser type on hybrid aspen increment and seed yield of perennial grass cultivated in the agroforestry system. *Agr. Res*. **2013**, *11*, 13-24

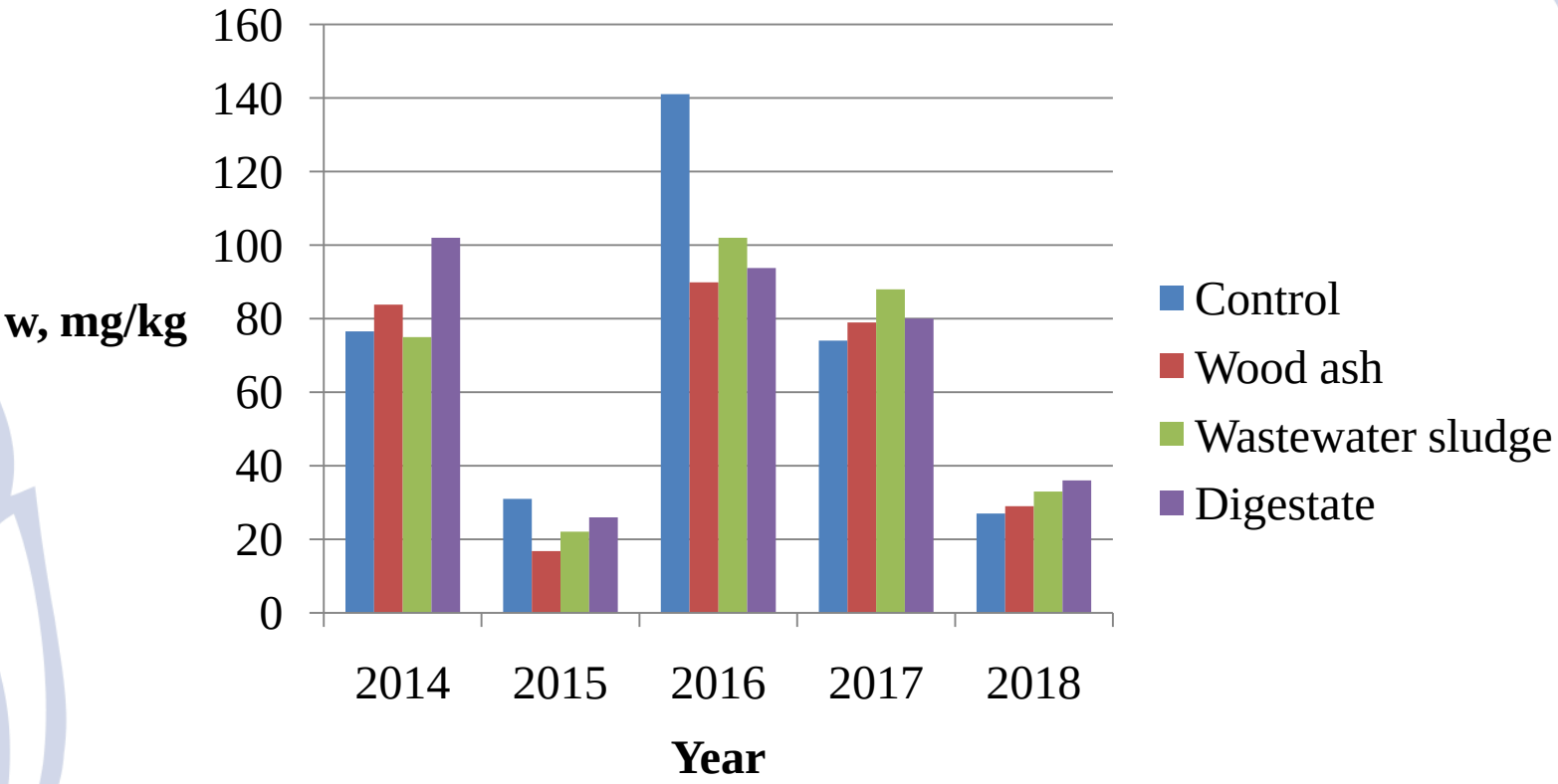
Results

Metal content in bolete and soil samples (mg/kg)

Sample	**Cr**	**Mn**	**Ni**	**Cu**	**Zn**
Boletes	0,07±0,02	5,0±0,5	0,26±0,04	26±4	31±5
Soil	3,6±0,7	150±40	0,5±0,2	1,2±0,2	4,1±1,3
Bioconcentration factor	0,02	0,03	0,5	21	8
Sample	**As**	**Sr**	**Cd**	**Pb**	
Boletes	0,18±0,03	0,5±0,2	0,33±0,07	0,046±0,011	
Soil	0,8±0,4	8,9±1,5	–	4,0±0,4	
Bioconcentration factor	0,2	0,06	–	0,011	

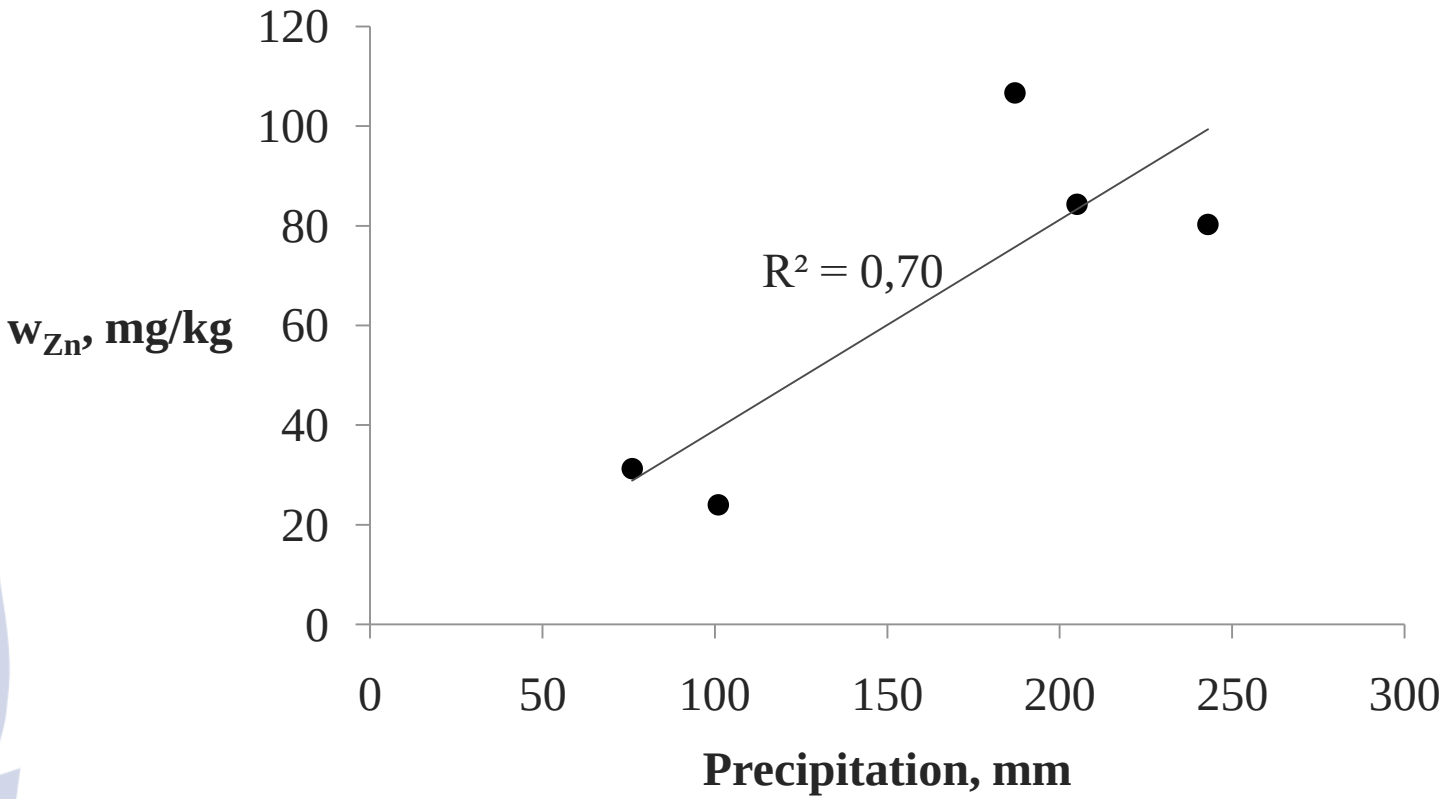
Results

Zn content in boletes



Results

Sum of precipitation in August/September and Zn content in boletus mushrooms



Results

Metal content in soil samples compared with regulations (mg/kg)

	Cr	**Mn**	**Ni**	**Cu**
Target value	4	–	3	4
Content in soil	3,6±0,7	150±40	0,5±0,2	1,2±0,2
	Zn	**As**	**Sr**	**Pb**
Target value	16	2	–	13
Content in soil	4,1±1,3	0,8±0,4	8,9±1,5	4,0±0,4

IRMS Results

Isotope-ratio mass spectrometry

Elevated $\delta^{15}N$ - anthropogenic pollution

Conclusion

1. Fertilizer type has minimal longterm (>3 years) influence on metal content in mushrooms.

2. Boletus mushrooms accumulate Cu un Zn.

3. There is a possible correlation between precipitation and Zn content in boletus mushrooms.

Thank you!