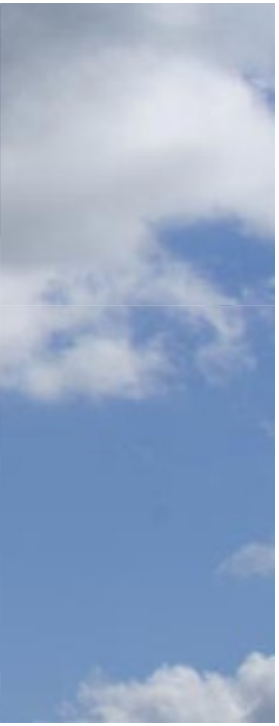
PHYTO 2 ENERGY

Phytoremediation driven energy crops production on heavy metal degraded areas as local energy carrier



Technical and economical aspects of field demonstration

MARIE CURIE ACTIONS

This project has received funding from European Community´s 7th Framework Programme (FP7/2007-2013) under Grant agreement 610797.

Benefits of approach

Ecological benefits

- remediation of contaminated land
- green capping

Economical benefits

- preservation of land use (agriculture)
- biomass production for energy

Social benefits

- (re-)introduction of land into production cycle (crops)
- assurance of employment (farmer)

pictures: www.lustreconsulting.com; www. lter.kbs.msu.edu

This project has received funding from the European Union's 7th Programme for research, technological development and demonstration under grant agreement *No* 610797

Land preparation


site characterization


weed control


mowing plants, milling soil


prepared plant bed

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Plant cultivation and growing


pre-cultivation of plants

or

rhizomes

planting

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Harvest of biomass

harvest


transport (and storage)

gasification

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Analysis for one-off costs

One-off costs	Costs[1] [EUR/ha]
Land preparation	
Weed control (optional)	50.00
Plowing	80.00
Plant bed preparation	20.00
Subtotal Land preparation	**150.00**
Cultivation and planting	
Rhizomes (0.20 EUR per plant; 10,000 plants/ha)	2,000.00
Planting by machine	450.00
Weed control	50.00
Additional planting for losses (15% of total rhizomes planted assumed, labor and material costs)	250.00
Fertilization (NPK)	100.00
Subtotal Cultivation and planting	**2,850.00**
TOTAL	**3,000.00**

[1] German price level, exemplarily for *Miscanthus x gigantheus*
sources: Ministry for Environment, Agriculture and Geology of Saxony (www.publications.sachsen.de), Service Center Rural Area (DLR) Eifel (www.dlr-eifel.rlp.de)

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Analysis for annual costs

Annual costs	Costs[1] [EUR/ha]
Harvest and transport of biomass (labor costs)	650.00
Storage of biomass (fixed costs for building)	350.00
Application of inoculum (2.230 EUR/ha, 500L/ha, application 100 EUR)	2,330.00
TOTAL	**3,330.00**

Total costs	Costs[1] [EUR/ha]
One-off costs	3,000.00
Annual costs for about 10 years	33,300.00
TOTAL	**36,300.00**

- costs for rent of agriculture land (150 EUR/ha[1]) and administrative costs (270 EUR/ha[1]) are not considered
- expenses for project management not included
- profit from gasification presented by Valentin Rusu (WP 3)

[1] German price level, exemplarily for *Miscanthus x gigantheus*
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Recommendation for full scale scenario

Bytom (Poland):

- *Spartina pectinata* / treatment with fertilization (NPK) and/or *Miscanthus x giganteus* / treatment with inoculum

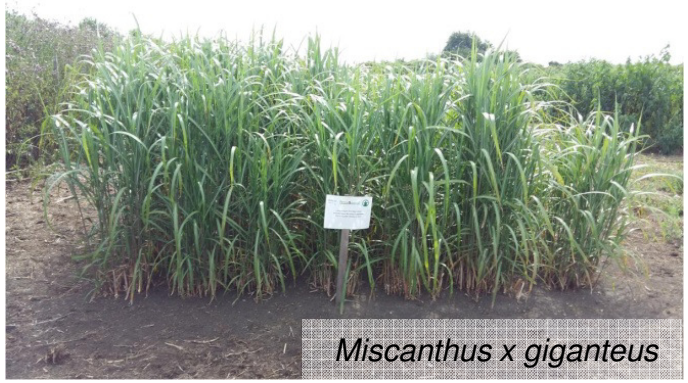
HM	Species, treatment	Yield [t/ha*a]	HM-Extraction [kg/ha*a]
Lead	*Spartina*, NPK	33.9	1.05
Cadmium	*Miscanthus*, inoculum	33.3	0.02
Zinc			3.51


Spartina pectinata

Leipzig (Germany):

- *Miscanthus x giganteus* / treatment with inoculum

HM	Species, treatment	Yield [t/ha*a]	HM-Extraction [kg/ha*a]
Lead	*Miscanthus*, inoculum	17.7	0.02
Cadmium			0.01
Zinc			2.36


Miscanthus x giganteus

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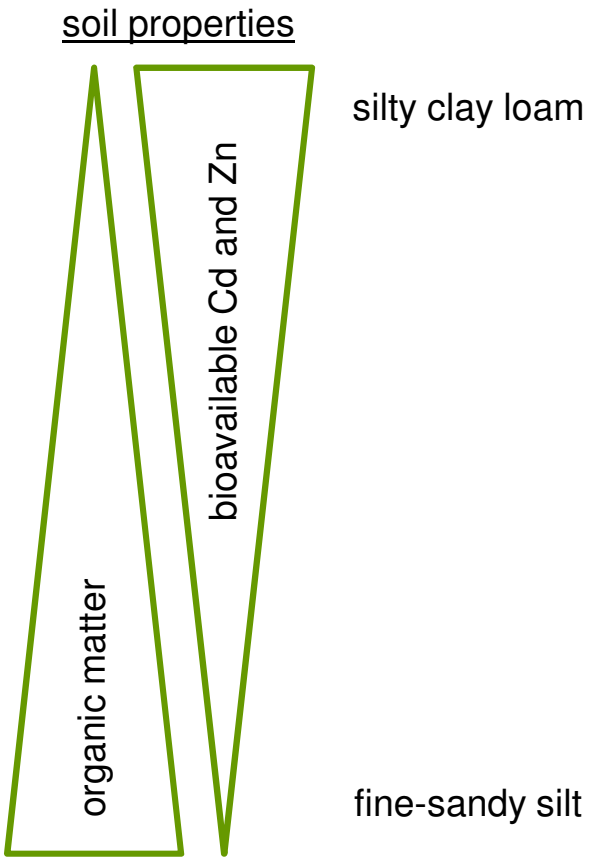

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Many thanks for your attention!

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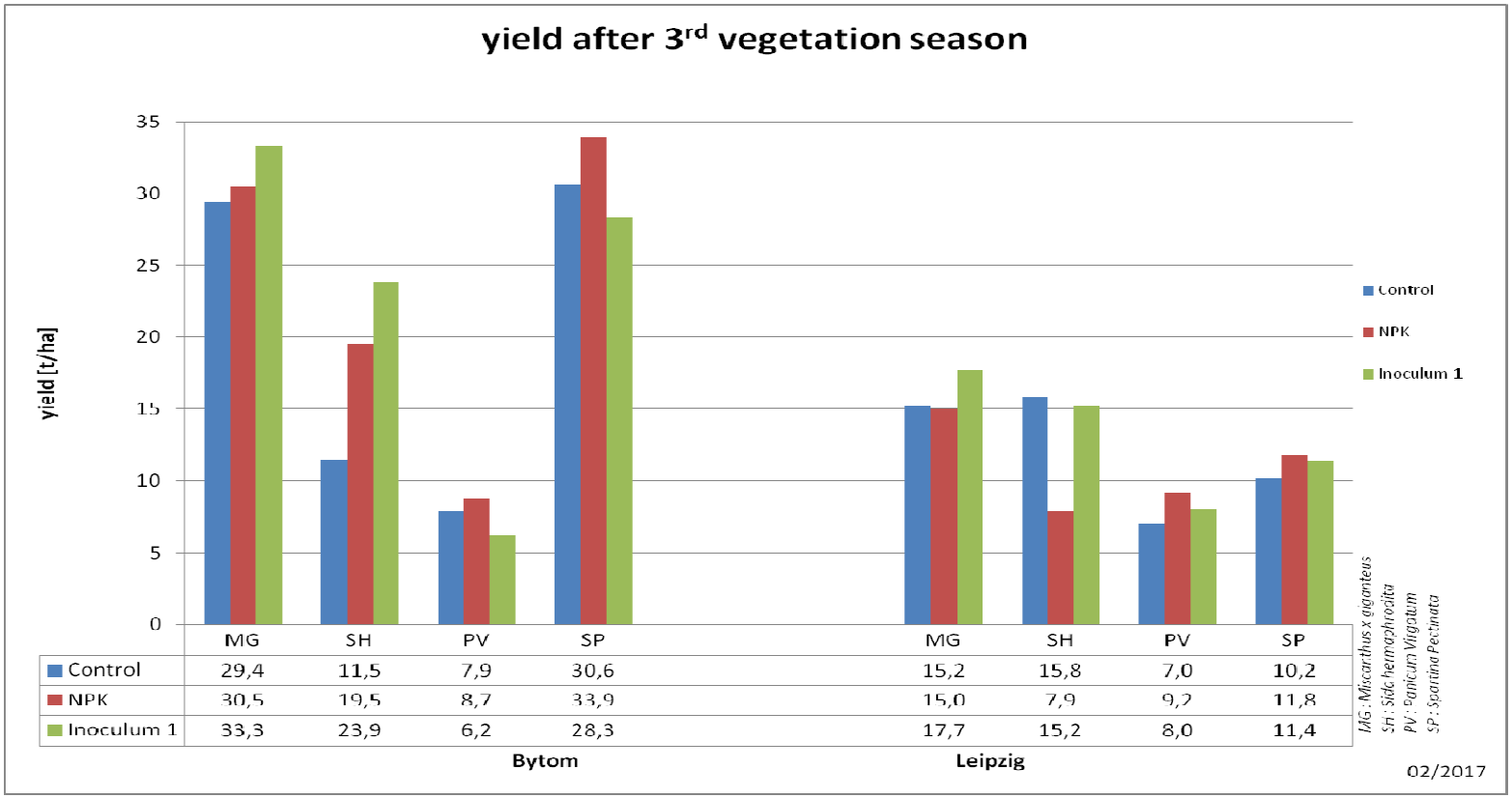
Biomass yield Phyto2Energy trial



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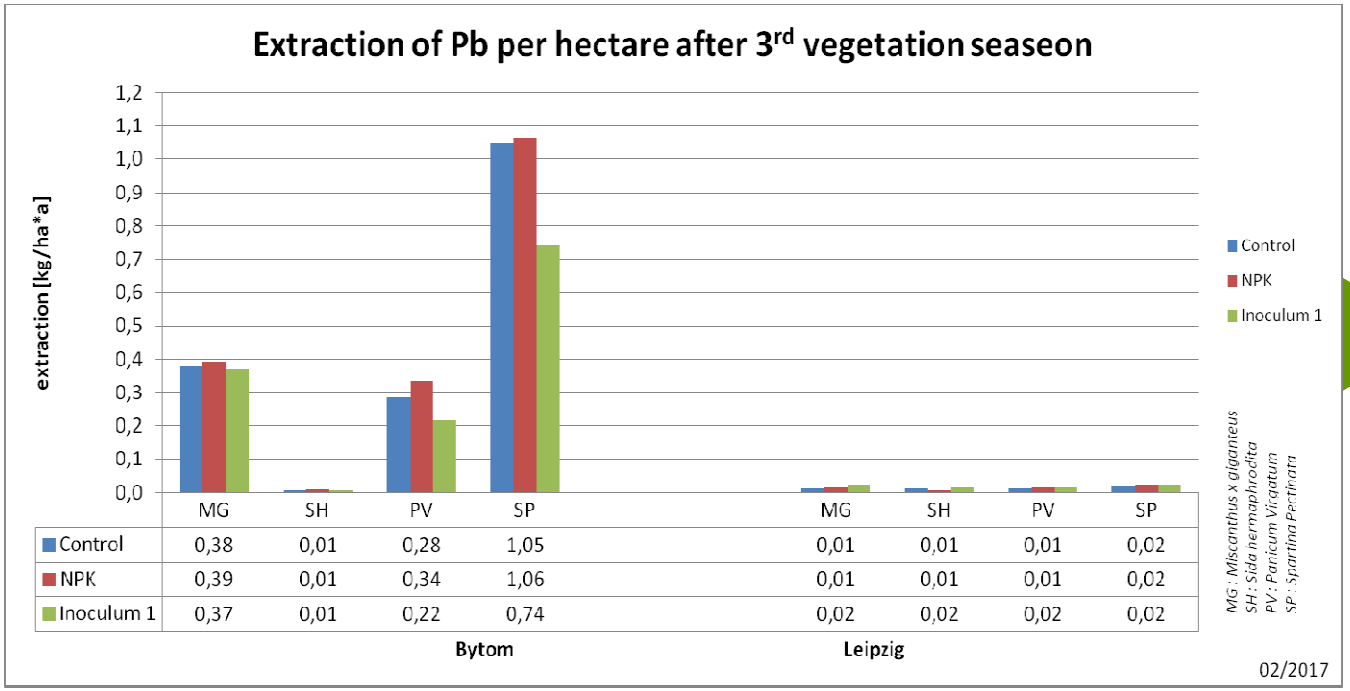
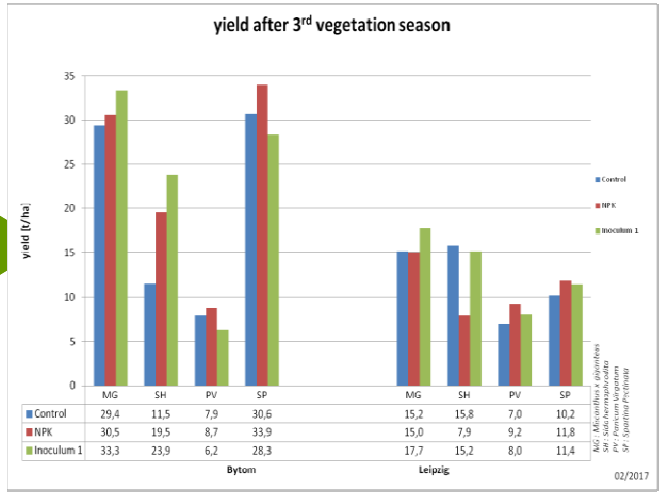
Extraction of Pb per hectare



	MG	SH	PV	SP	MG	SH	PV	SP
	Bytom				Leipzig			
Control	0,38	0,01	0,28	1,05	0,01	0,01	0,01	0,02
NPK	0,39	0,01	0,34	1,06	0,01	0,01	0,01	0,02
Inoculum 1	0,37	0,01	0,22	0,74	0,02	0,02	0,02	0,02



	MG	SH	PV	SP	MG	SH	PV	SP
	Bytom				Leipzig			
Control	29,4	11,5	7,9	30,6	15,2	15,8	7,0	10,2
NPK	30,5	19,5	8,7	33,9	15,0	7,9	9,2	11,8
Inoculum 1	33,3	23,9	6,2	28,3	17,7	15,2	8,0	11,4

- highest yield at highest extraction of Pb after 3rd vegetation season:
  - in Bytom for *Spartina pectinata* – NPK variant
  - in Leipzig for *Miscanthus x giganteus* – Inoculum variant

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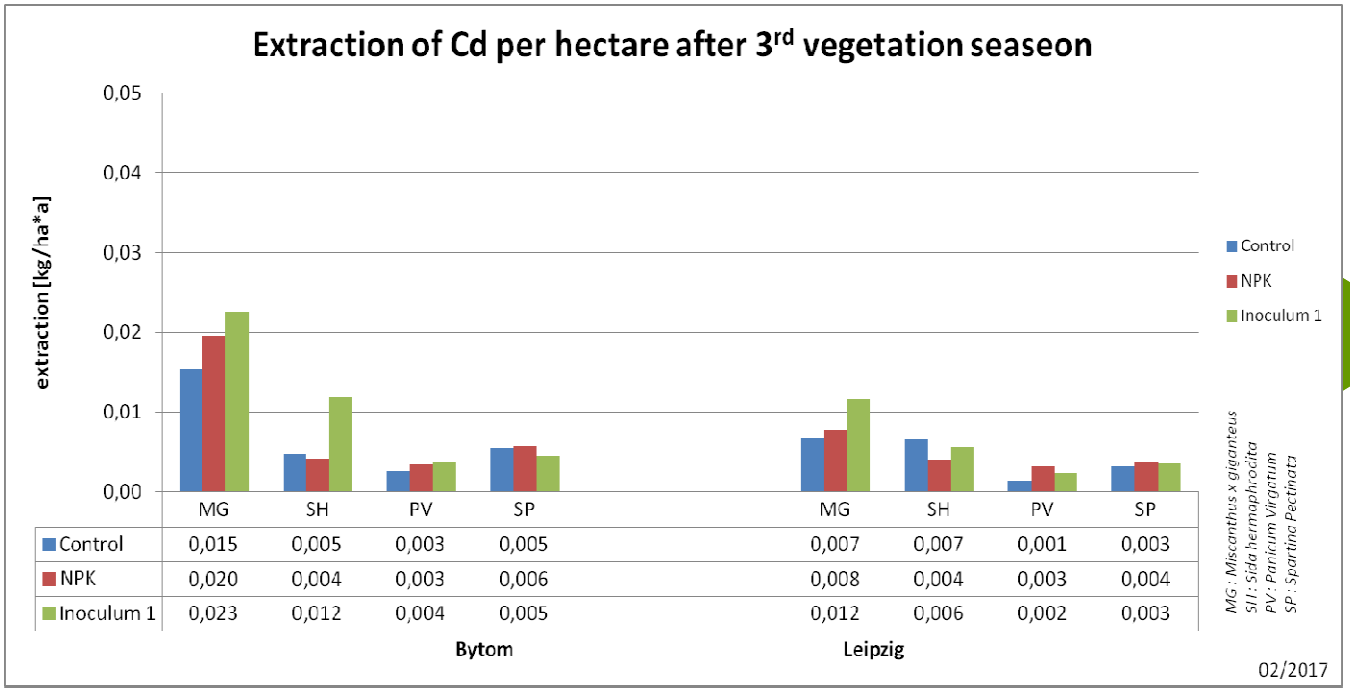
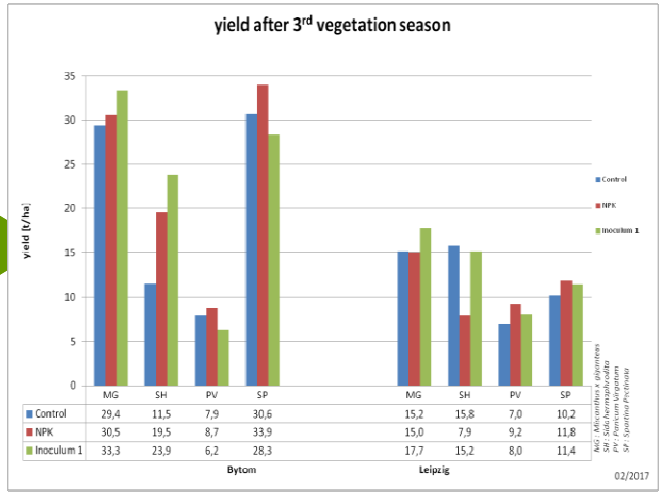
Extraction of Cd per hectare



	MG	SH	PV	SP	MG	SH	PV	SP
Control	0,015	0,005	0,003	0,005	0,007	0,007	0,001	0,003
NPK	0,020	0,004	0,003	0,006	0,008	0,004	0,003	0,004
Inoculum 1	0,023	0,012	0,004	0,005	0,012	0,006	0,002	0,003



	MG	SH	PV	SP	MG	SH	PV	SP
Control	29,4	11,5	7,9	30,6	15,2	15,8	7,0	10,2
NPK	30,5	19,5	8,7	33,9	15,0	7,9	9,2	11,8
Inoculum 1	33,3	23,9	6,2	28,3	17,7	15,2	8,0	11,4

- highest yield at highest extraction of Cd after 3rd vegetation season:
  - ➢ in Bytom and Leipzig for *Miscanthus x giganteus* – Inoculum variant

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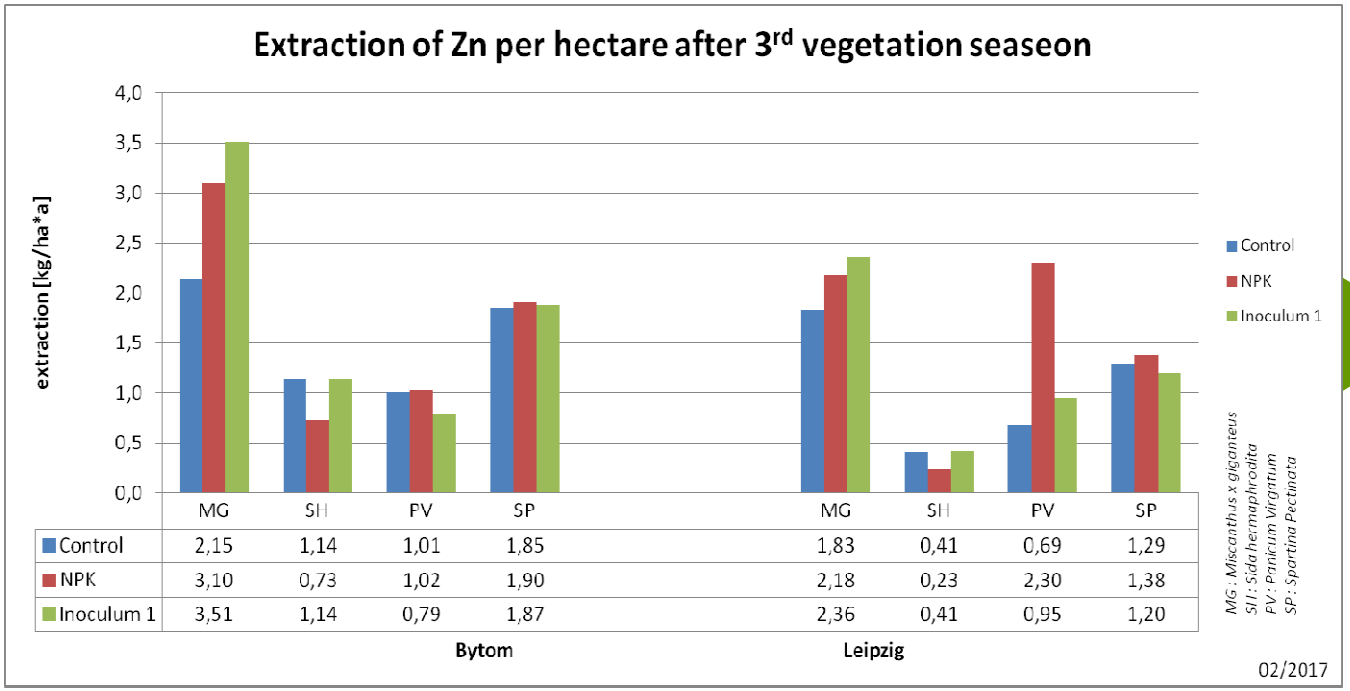
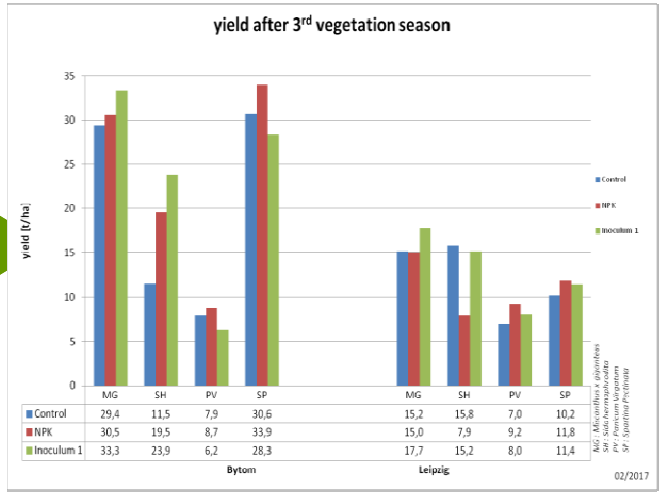
Extraction of Zn per hectare



	MG	SH	PV	SP	MG	SH	PV	SP
Control	2,15	1,14	1,01	1,85	1,83	0,41	0,69	1,29
NPK	3,10	0,73	1,02	1,90	2,18	0,23	2,30	1,38
Inoculum 1	3,51	1,14	0,79	1,87	2,36	0,41	0,95	1,20



	MG	SH	PV	SP	MG	SH	PV	SP
Control	29,4	11,5	7,9	30,6	15,2	15,8	7,0	10,2
NPK	30,5	19,5	8,7	33,9	15,0	7,9	9,2	11,8
Inoculum 1	33,3	23,9	6,2	28,3	17,7	15,2	8,0	11,4

- highest yield at highest extraction of Cd after 3rd vegetation season:
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