

Maa- ja elintarviketalouden tutkimuskeskus | Agrifood Research Finland | Forskningscentralen för jordbruk och livsmedels ekonomi



Effects of Repeated Municipal Waste Compost Fertilizations on Soil and Plants in a Crop Rotation Field Experiment in Finland

Tontti, T. ⁽¹⁾, Palojärvi, A. ⁽²⁾, Heinonen-Tanski, H. ⁽³⁾, Halinen, A. ⁽¹⁾ & Karinen, P. ⁽³⁾

⁽¹⁾ MTT Agrifood Research Finland, Lönnrotinkatu 3, 50100 Mikkeli, Finland, E-Mail tiina.tontti@mtt.fi Internet www.mtt.fi


⁽²⁾ MTT Agrifood Research Finland, 31600 Jokioinen, Finland, E-Mail ansa.palojarvi@mtt.fi Internet www.mtt.fi

⁽³⁾ University of Kuopio, Dep. of Env. Sci., POB 1627, 70211 Kuopio, Finland, E-Mail heinotan@uku.fi Internet www.uku.fi



www.mtt.fi

Maa- ja elintarviketalouden tutkimuskeskus | Agrifood Research Finland | Forskningscentralen för jordbruk och livsmedels ekonomi




MATERIALS AND METHODS

Field experiment

- managed organically
- **crop rotation**

Compost fertilizations


- tunnel composted municipal waste, mature, sieved
- **Biowaste (B)**, source separated municipal biowaste (ssmb)
- **BioSludge (BS)**, cocomposted ssmb + anaerobically digested sewage sludge
- control treatments; composted **CattleManure (CM)**, unfertilized control



2000	2001	2002	2003	2004	2005
cereal	clover-grass	clover-grass	barley	potato	cereal
compost (B, BS, CM)				compost (B, BS, CM)	compost (B, BS, CM)


Management and sampling

- composts applied as fertilizers, based on N or P amounts
- light harrowing and plant seeding
- plant samples from harvestings
- soil samples in spring and autumn (mid-summer)




www.mtt.fi

Maa- ja elintarviketalouden tutkimuskeskus | Agrifood Research Finland | Forskningscentralen för jordbruk och livsmedels ekonomi




Treatments and crop rotation in the experiment


	2000		2001	2002	2003	2004		2005	
	Cereal (nurse-crop) t/ha	N / P (kg/ha)	Clover-Grass		Barley	Potato t/ha	N / P (kg/ha)	Cereal (nurse-crop) t/ha	N / P (kg/ha)
Zero-control	-	-	-	-	-	-	-	-	-
CattleManure _{low}	17	367/91	-	-	-	5	48/7	25	194/33
Biowaste _{low}	23	257/51	-	-	-	3	57/14	26	298/126
BioSludge _{low}	9	126/60	-	-	-	3	41/27	23	347/204
CattleManure _{high}	33	720/178	-	-	-	9	86/13	50	389/65
Biowaste _{high}	45	503/100	-	-	-	6	113/27	52	596/253
BioSludge _{high}	18	248/117	-	-	-	5	69/45	46	693/409



Maa- ja elintarviketalouden tutkimuskeskus | Agrifood Research Finland | Forskningscentralen för jordbruk och livsmedels ekonomi




COMPOST QUALITY




Average chemical characteristics of the applied composts

	Total nutrients (g/kg DM)			Soluble nutrients (g/kg DM)			Trace elements ⁽⁵⁾ (mg/kg DM)								
	N ⁽¹⁾	P ⁽²⁾	Org.C ⁽¹⁾	N ⁽³⁾	P ⁽⁴⁾	K ⁽⁴⁾	As*	Cd	Cr	Cu	Hg	Ni	Pb	Zn	
CattleManure	27	6	444	2.0	3.6	29	0.7	0.09	5	21	0.07	4	4	104	
Biowaste	29	8	313	2.2	1.6	6	4.1	0.33	34	66	0.17	13	21	175	
BioSludge	28	16	292	2.5	0.3	3	3.7	0.51	41	120	0.31	17	20	305	
Finnish limits ⁽⁶⁾							25	1.5	300	600	1.0	100	100	1500	
Organic limits ⁽⁷⁾								0.7	70	70	0.4	25	45	200	

⁽¹⁾ N, C; dry combustion (Leco), ⁽²⁾ wet combustion, ⁽³⁾ soluble N=ammonium (NH₄-N) + nitrate (NO₃-N), KCl extraction, ⁽⁴⁾ soluble P and K; AAAC extraction, ⁽⁵⁾ trace elements from AR extraction (*As from wet combustion), ⁽⁶⁾ Statute of the Finnish Ministry of Agriculture and Forestry 12/2007, ⁽⁷⁾ Council regulation (EEC) 2092/91




Maa- ja elintarviketalouden tutkimuskeskus | Agrifood Research Finland | Forskningscentralen för jordbruk och livsmedels ekonomi




APPLIED COMPOST AND NITROGEN in compost fertilizations

	2000 cereal			2004 potato			2005 cereal		
	CM	B	BS	CM	B	BS	CM	B	BS
Low application									
Applied compost (t fm/ha)	17	23	9	5	3	3	25	26	23
Total N (kg/ha)	367	257	127	45	63	37	194	298	347
Soluble N (kg/ha) ⁽¹⁾	10	23	9	3	5	2	25	18	44
High application									
Applied compost (t fm/ha)	33	45	18	9	6	5	50	52	46
Total N (kg/ha)	712	503	253	90	119	74	389	596	693
Soluble N (kg/ha) ⁽¹⁾	20	44	18	6	10	4	49	36	89

⁽¹⁾ Soluble N (NH₄ + NO₃) measured from samples taken during the compost application in spring



Maa- ja elintarviketalouden tutkimuskeskus | Agrifood Research Finland | Forskningscentralen för jordbruk och livsmedels ekonomi




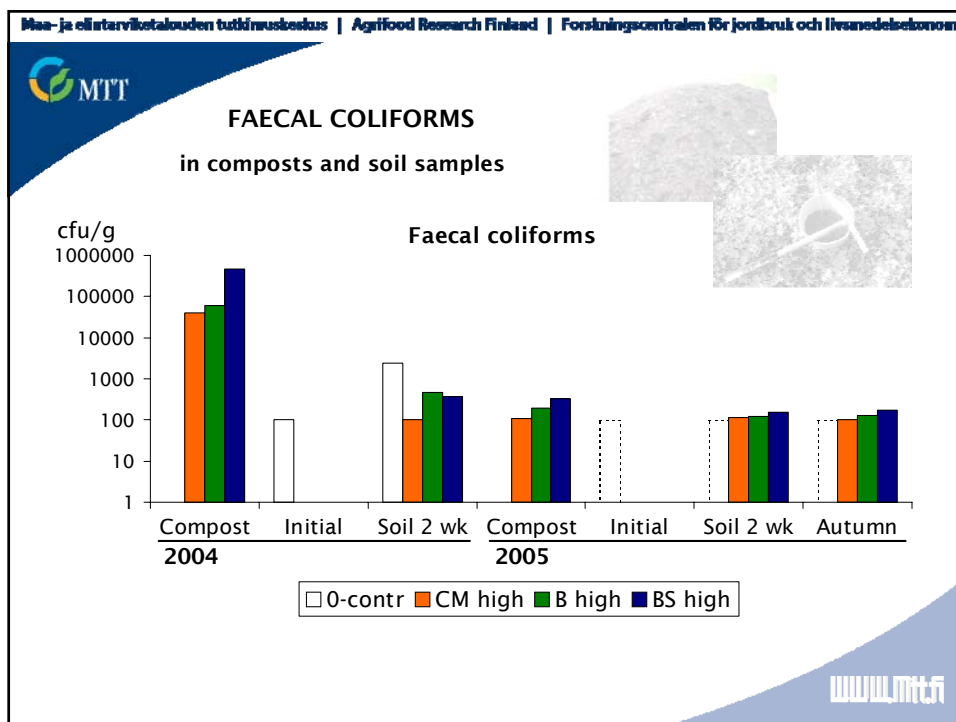
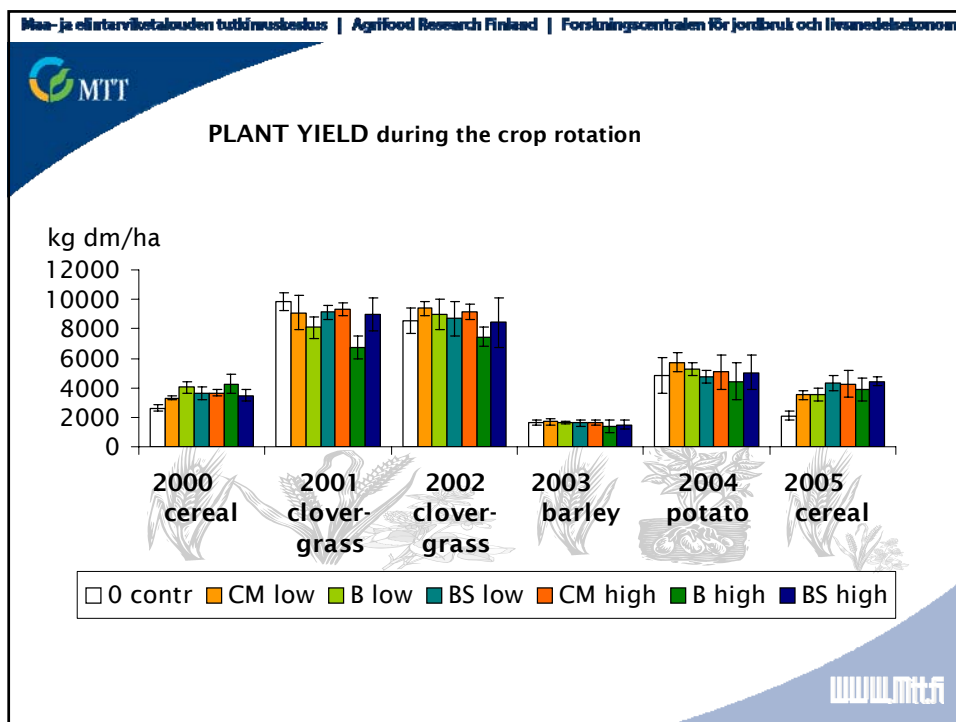
SOIL CONTENTS

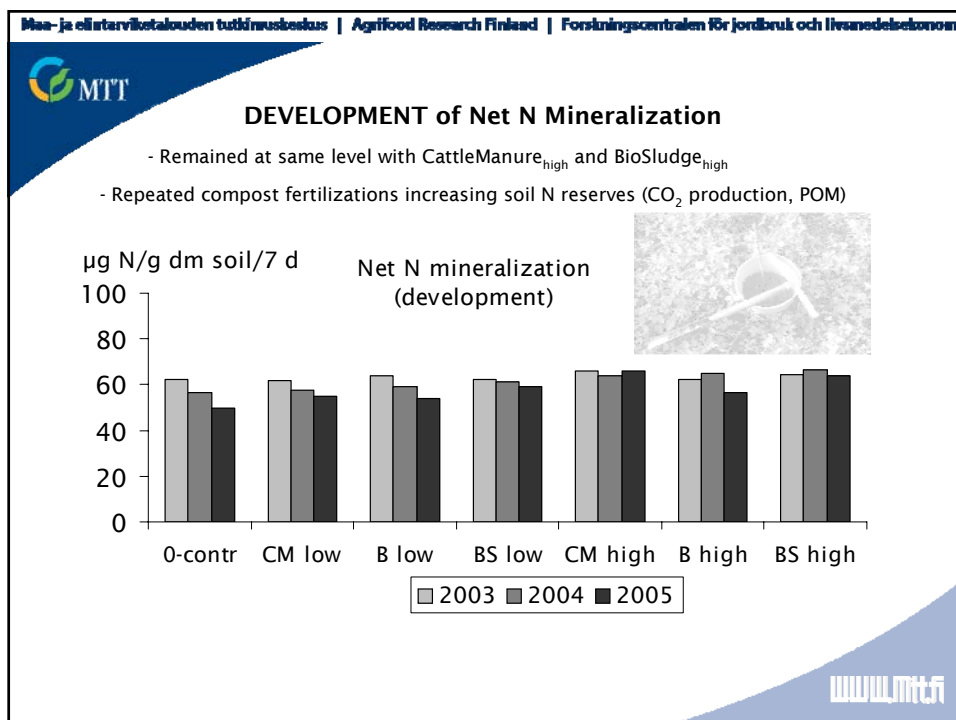
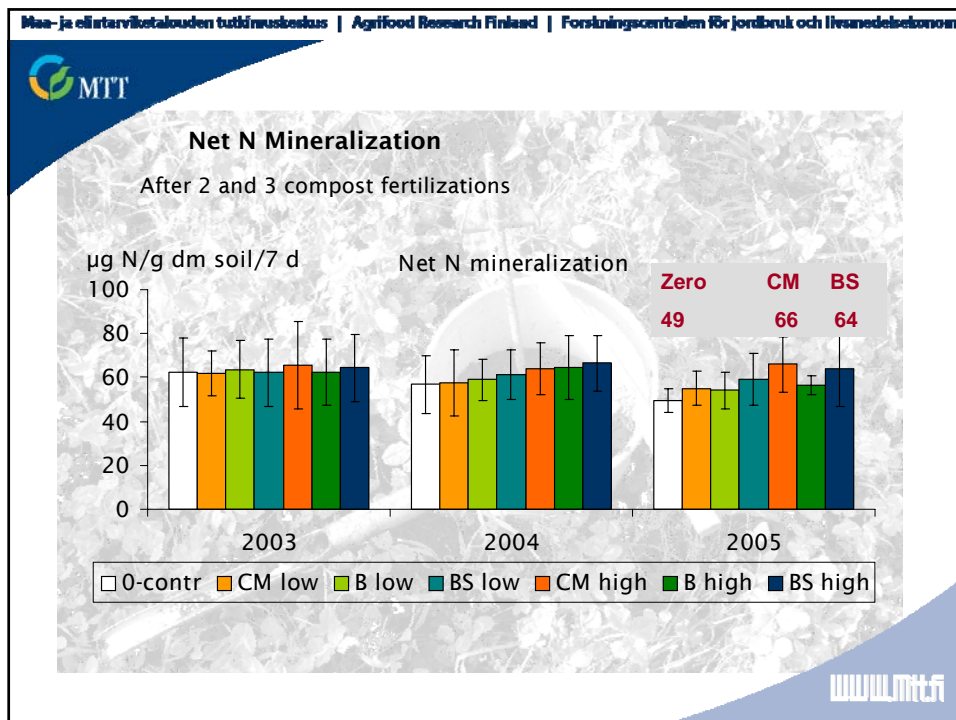
Initial and final contents of Cu and Zn in soil and amounts applied

	Copper (mg/kg DM soil) ⁽¹⁾			Zinc (mg/kg DM soil) ⁽¹⁾		
	2000 spring	2005 autumn	applied ⁽²⁾ (kg/ha)	2000 spring	2005 autumn	applied ⁽²⁾ (kg/ha)
Zero control	22	21	0	71	66	0
CattleManure _{low}	22	28	0.5	74	67	2.6
Biowaste _{low}	23	21	1.6	74	66	4.2
BioSludge _{low}	22	21	2.1	80	73	5.1
CattleManure _{high}	22	21	1.0	93	86	5.1
Biowaste _{high}	21	21	3.1	93	81	8.3
BioSludge _{high}	22	21	4.2	86	78	10.2


⁽¹⁾ Cu and Zn from AR extraction. ⁽²⁾ Sum of Cu (kg/ha) and Zn (kg/ha) added into soil in 3 compost applications.







Maa- ja elintarviketalouden tutkimuskeskus | Agrifood Research Finland | Forskningscentralen för jordbruk och livsmedels ekonomi



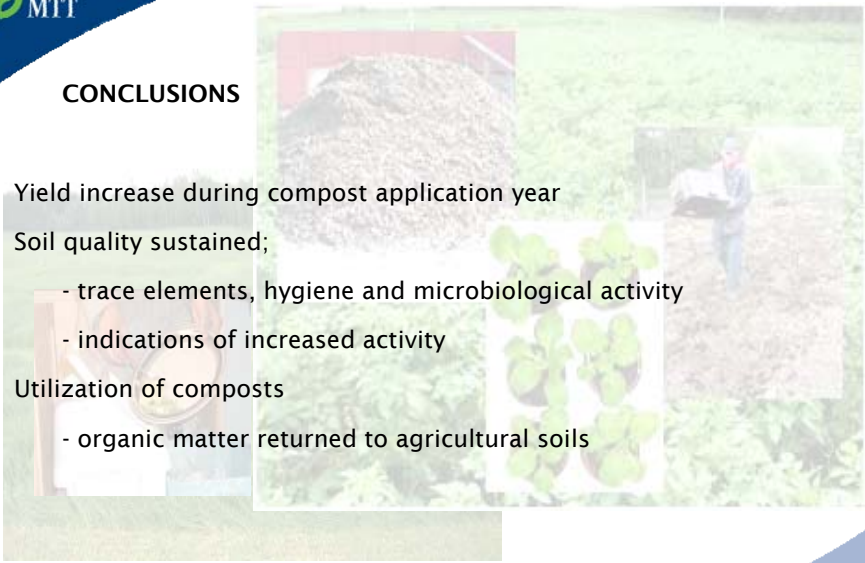
CONCLUSIONS

Yield increase during compost application year
Soil quality sustained;

- trace elements, hygiene and microbiological activity
- indications of increased activity

Utilization of composts

- organic matter returned to agricultural soils



www.mtt.fi

Maa- ja elintarviketalouden tutkimuskeskus | Agrifood Research Finland | Forskningscentralen för jordbruk och livsmedels ekonomi



Thank you for Your attention!

Acknowledgements:

Miia Kuisma
Keijo Lehtonen

Ansa Palojärvi
Arja Halinen
Olli Reinikainen/Vapo Ltd.

Finnish Ministry of Agriculture and Forestry
Finnish Ministry of Environment
MTT Agrifood Research Finland
Finnish Graduate School of Environmental Science and Technology



www.mtt.fi