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Application of compost to arable land: Improvement of soil quality with compost

Workshop: Farm Management and Composting in Rural Areas

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Application of compost in arable land

- **Compost: consists of different organic materials:**
 - stable manure
 - garden waste
 - lawn-cut, tree-cut,
 - organic waste from households
 - leaves from park trees



Effects of compost in arable land

- Improvement of soil by building humus
- Improvement of nitrogen supply
- Supply with phosphorus, potassium, magnesia and minor elements
- Improvement of plant health



Properties of compost

- plant nutrients are delivered slowly, so they are directly available for plants
- positive effects on soil structure
- stimulation of soil organism
- guarantees high soil fertility
- no salting of soil



Field trials with compost

- 1992 – 2001 at Gumpenstein
- Comparison of compost, stable manure, cattle slurry, mineral fertilizer with N and without N
- Crops: silage-maize
 - summer-barley with clover-grass
 - clover-grass
 - potatoes
 - summer-rye



Nutrients of compost 1992-2001

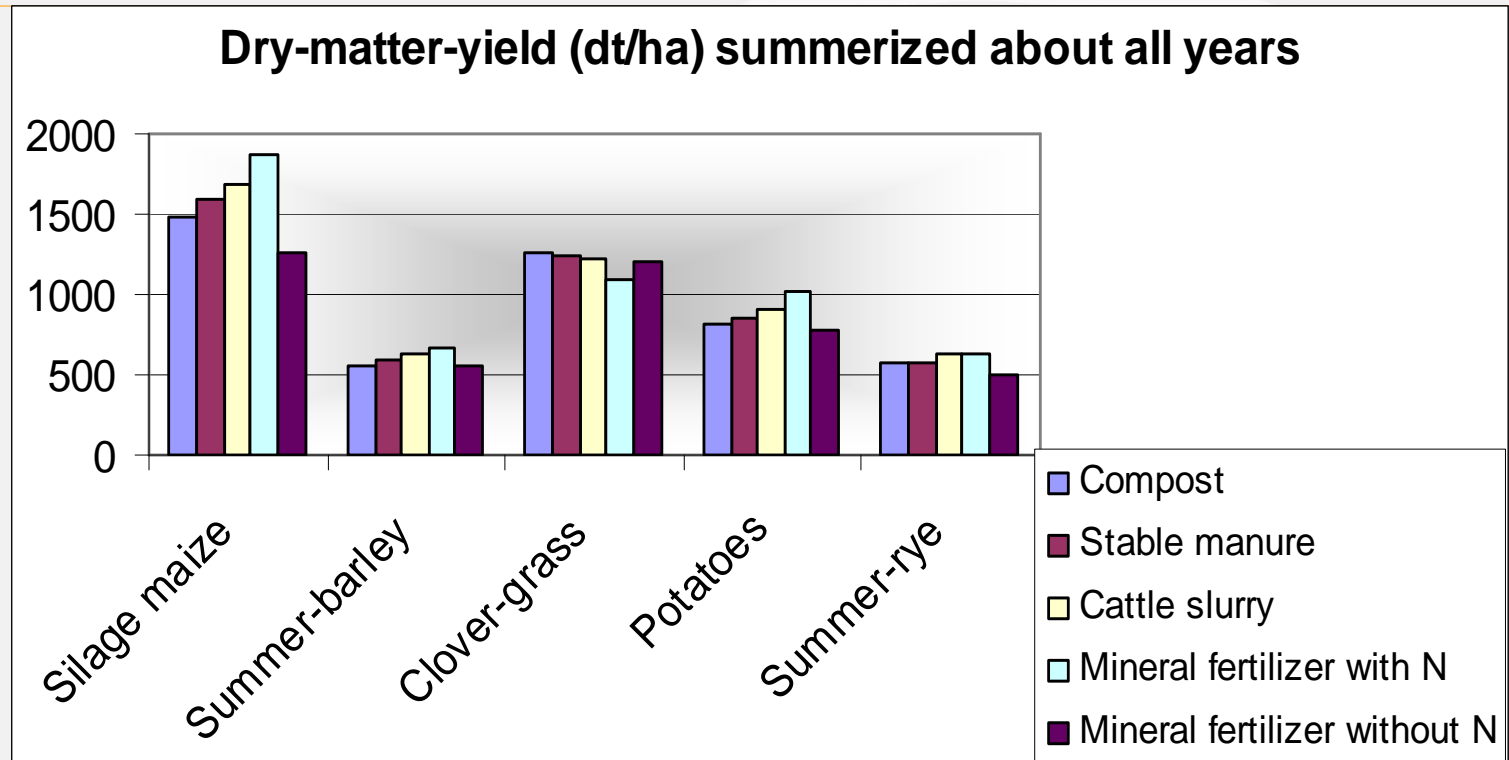
Years	DM	Ash	Calcium	Magnesia	Potassium	Phosphorus	Nitrogen	pH-value
1993	465,88	312,84	15,24	5,77	6,94	3,14	8,61	7,85
1994	350,96	207,84	5,49	2,99	6,28	2,27	6,35	7,95
1995	355,12	220,64	6,48	3,68	7,51	2,47	6,51	8,68
1996	242,98	80,84	5,05	2,10	11,80	2,67	8,10	9,08
1997	296,74	98,66	9,20	3,02	8,54	3,61	11,12	8,00
1998	229,02	74,40	3,31	1,30	8,15	2,69	5,78	8,42
1999	223,86	81,22	9,20	3,50	5,96	3,18	6,61	8,24
2000	301,72	112,28	11,28	5,04	8,06	3,86	9,17	8,82
2001	252,64	87,32	8,76	4,70	9,84	2,61	7,26	7,99

The values are given in g/kg DM

The chemical composition of compost differs from year to year, it depends on the basic materials of stable manure



Results: Dry-matter-yield



It can be seen that the variant with mineral fertilizer with N has the highest yield in the most cases, with exception of clover-grass. The variant with compost is on average of all fertilizing-variants.

The dry-matter-yield of cereals contends kernel-yield as well as straw-yield.



Results: Investigation of soil

	pH-value	Humus %	P ₂ O ₅ g/100 g soil	K ₂ O g/100 g soil	Mg g/100 g soil
Silage maize					
Compost	5,91	3,58	23,83	16,47	10,76
Stable manure	5,97	3,74	24,36	19,03	12,96
Cattle slurry	5,93	3,62	22,11	19,82	10,31
NPK	5,82	3,59	22,80	20,25	9,59
PK	5,75	3,60	24,23	21,73	10,31
Summer-barley					
Compost	5,78	3,81	25,10	17,69	10,40
Stable manure	5,87	3,85	25,19	19,51	10,77
Cattle slurry	5,87	3,78	24,74	20,40	10,31
NPK	5,75	3,80	24,51	19,93	9,52
PK	5,78	3,73	24,96	20,81	10,01
Clover-grass					
Compost	5,81	3,86	22,03	11,13	9,63
Stable manure	5,74	3,81	21,89	9,56	9,44
Cattle slurry	5,71	3,80	21,77	11,78	8,96
NPK	5,62	3,72	21,90	10,70	8,63
PK	5,71	3,67	22,37	10,38	8,70
Potatoes					
Compost	5,77	3,56	20,70	14,10	11,04
Stable manure	5,77	3,65	24,34	14,51	12,56
Cattle slurry	5,80	3,72	23,84	15,33	13,85
NPK	5,54	3,85	21,78	14,19	10,91
PK	5,73	3,69	22,64	15,12	9,65
Summer-rye					
Compost	5,82	3,67	26,22	16,22	10,94
Stable manure	5,90	3,80	24,83	16,96	12,26
Cattle slurry	5,93	3,75	22,65	18,82	11,30
NPK	5,83	3,72	23,14	18,40	10,72
PK	5,79	3,73	25,94	18,92	10,16



Results: Soil aggregate stability

Variants	Silage maize	Summer-barley	Clover-grass	Potatoes	Summer-rye
Compost	68,08	73,45	74,18	69,72	69,74
Stable manure	70,70	73,18	75,04	69,59	70,37
Cattle Slurry	70,74	74,38	74,82	71,28	72,59
Mineral fertilizer with N	65,88	69,71	71,99	66,48	66,81
Mineral fertilizer without N	67,16	69,90	71,66	66,11	69,96

The aggregate stability was made after the method of Kemper and Koch.

There is almost no difference between compost and stable manure. The variants with the worst aggregate stability was the mineral fertilizing with N, but generally the aggregate stability is very high.



Conclusions of the field trials

- **The effect of the fertilizing variant on yield differed only a little bit between compost and stable manure**
- **The investigation of soil after all years of field trials could not show big differences between compost and stable manure**
- **The soil aggregate stability was almost equal with compost and stable manure but better than mineral fertilizers**



Soil organisms

- Investigations were made by colleagues from Joanneum Research Graz, they took samples three times in 1993 and 1994 (spring, summer, autumn)
- In spring 1993 the number of soil organisms on the variants with stable manure were higher than on compost, but that changed in June
- In 1994 there were more soil organisms on the variants with stable manure in comparison to compost



Soil microbiology

- **Samples for investigations were taken by colleagues from Joanneum Research Graz at the same time than soil organisms**
- **More biological activity was found in the variants of stable manure than compost but the differences were only small**



Applying the compost in the trials



Field trials at Gumpenstein



Applying of compost in organic farming

- **Compost (made of stable manure by converting the material three times) is a good fertilizer for organic farming**
- **Fresh stable manure is not favoured by organic farmers so it has to be changed by a machine, afterwards the material is good for fertilizing**



Situation at Lambach

- **The stable manure is from our branch in Wels (pigs, sheep, goats and cattle with much straw)**
- **Twice a year we transport the stable manure to Lambach and change it with a compost-machine**
- **We make long heaps for storing and to change the material**



Chemical composition of compost

Compost	DM	Ash	Ca	Mg	K	P	N	NH-4N	pH-Value
Made 2007	233,88	72,26	7,24	2,12	9,20	2,71	7,01	<100mg	7,45
Made 2008	271,16	104,37	2,09	0,85	2,26	1,08	8,54	<100mg	7,64
Made 2009	208,87	71,30	8,46	2,52	7,92	2,73	5,72	<100mg	6,78
Made 2009	242,32	115,9	20,04	4,24	4,70	8,64	6,73	<100mg	7,10
Made 2009	234,12	79,08	7,96	2,42	12,40	3,43	7,70	<100mg	7,63
Made 2009	446,85	335,28	10,72	4,04	5,60	3,99	4,99	<100mg	7,08

The stable manure is taken from Wels to Lambach twice a year. Normally the compost is used in autumn for winter-cereals and in spring for other crops.

The amount depends on the crop, the soil characteristics and the chemical composition of the compost.



Producing compost



Attention should be paid

- **Compost should be rotted well before applying**
- **Compost should be free of coarse-grained parts (of wood)**
- **Compost should be free of seeds from weed and infection**
- **Compost should be free of extraneous material (plastic and metal)**



Thank you for your attention!

