Using Compost Efficiently and Wisely

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The Organic Force

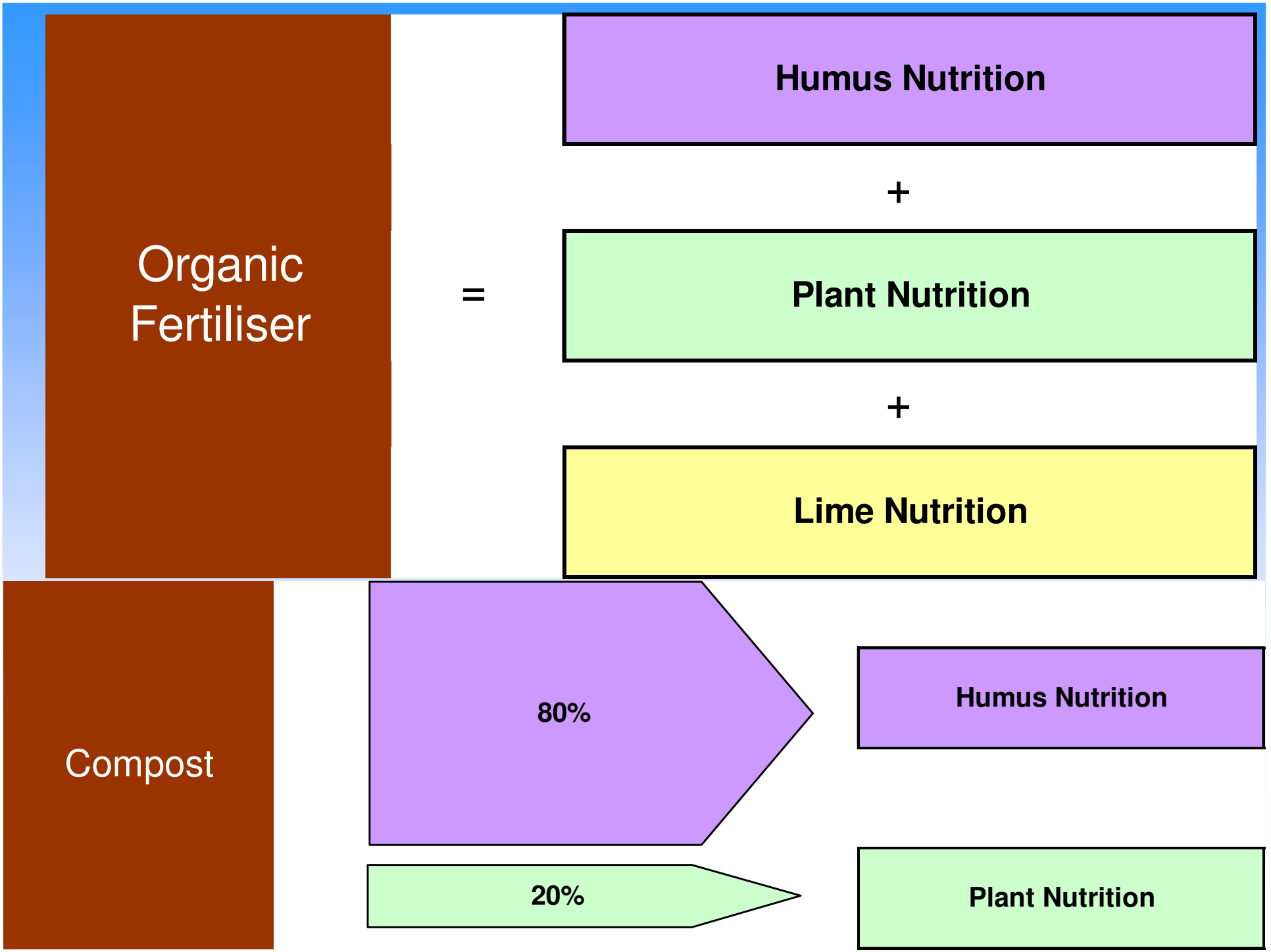
QUT ife Institute for Future Environments

Product

- Macro Nutrients (N,P,K,Mg,Ca)
- Micro Nutrients (S,Mn,B,Mo….)
- Neutral pH
- Liming properties
- Organic Matter (30 – 50%)
- High CEC
- High Water Holding Capacity
- Low bulk density

Active Ingredients

Product characteristic	**Unit**	
Bulk density	g / lt	0.5
Moisture	%	34.4
Organic carbon	% dm	25.926
Organic matter	% dm	44.70
C/N Ratio		21.6
pH	-	7.1
Conductivity	dS/m	3.8
Total phosphorus	% dm	0.31
Phosphorus - Colwell extr.	mg / kg	Not tested
Orthophophate	mg / kg	4.746 ug/L
Total nitrogen	% dm	1.2
Ammonium - N	mg / kg	2.59 mg/L
Nitrate - N	mg / kg	169 mg/L
Ammonium + Nitrate - N	mg / kg	172 mg/L
Potassium (soluble)	mg / kg	1900
Potassium	% dm	0.36
Boron	mg / kg	26
Calcium (soluble)	mg / kg	5800
Calcium	% dm	2.76
Molybdenum	mg / kg	6.9
Manganese	mg / kg	240
Magnesium (soluble)	mg / kg	1,500
Magnesium	% dm	0.44
Sodium (soluble)	mg / kg	1500
Sodium	% dm	0.23
Chloride	mg/L	
Sulphur	% dm	0.25
Iron	mg / kg	44,000
Exchangable Calcium	mequival/100g	28.8
Exchangeable Sodium	mequival/100g	6.6
Exchangable Potassium	mequival/100g	4.81
Exchangable Magnesium	mequival/100g	12.61
Ca/Mg Ratio		2.3
Cation Exchange Capacity	mequival/100g	52.82
Water holding capacity	%	56.9
Toxicity	cm	6.4
Maturity (self heating)	°C	22.2
Nitrogen Drawdown Index		0.4
Viable seeds and plant propagules	No. / lt (21 days)	0
Impurities		
Glass, metal and rigid plastic > 2mm	% dm	Trace
Plastic – light, flexible or film > 5mm	% dm	0.03
Stones and lumps of clay ≥ 5mm	% dm	6.6
Pathogens[#]		
E. coli	MPN/g	< 3
Faecal coliforms	MPN/g	150
Salmonella	in 25 g	Not detcted
Heavy Metals[#]		
Arsenic (Total)	mg / kg	8.6
Cadmium (Total)	mg / kg	0.4
Cadmium (Total) - second sample	mg / kg	0.16


Organic Fertiliser
=
Humus Nutrition
+
Plant Nutrition
+
Lime Nutrition
Compost
80%
20%
Humus Nutrition
Plant Nutrition

Fertilising Effects (Trial Results)

- Compost use for 9 / 12 years at 5 sites
  (sandy, loamy, clay soils)
- Compost made from garden + food organics
  (1.4% N, 0.3% P, 0.9% K, 38% OM, C/N 17)
- Application: 0, 5, 10, 20 t DM /ha annually
- + 0, 50, 100% recommended N
- Rotation: corn / wheat / barley

Results

Optimum Application Rate
6 – 10 t DM/ha/year

- **Nutrient Balance -** ***Total Nutrients***
  - about balanced for N, P and K
  - large surplus for Mg

Results – P, K & Mg

Nutrient Balance – *Plant Available Nutrients*

- **Phosphorus**
  - 15 – 25% soluble (high fertilising efficiency)
  - increased soil P
  - longer-term: 80 – 100% accountable
- **Potassium**
  - 65 – 70% soluble (high fertilising efficiency)
  - increased soil K
- **Magnesium**
  - 7 – 10% soluble (low fertilising efficiency)
  - no increased soil Mg

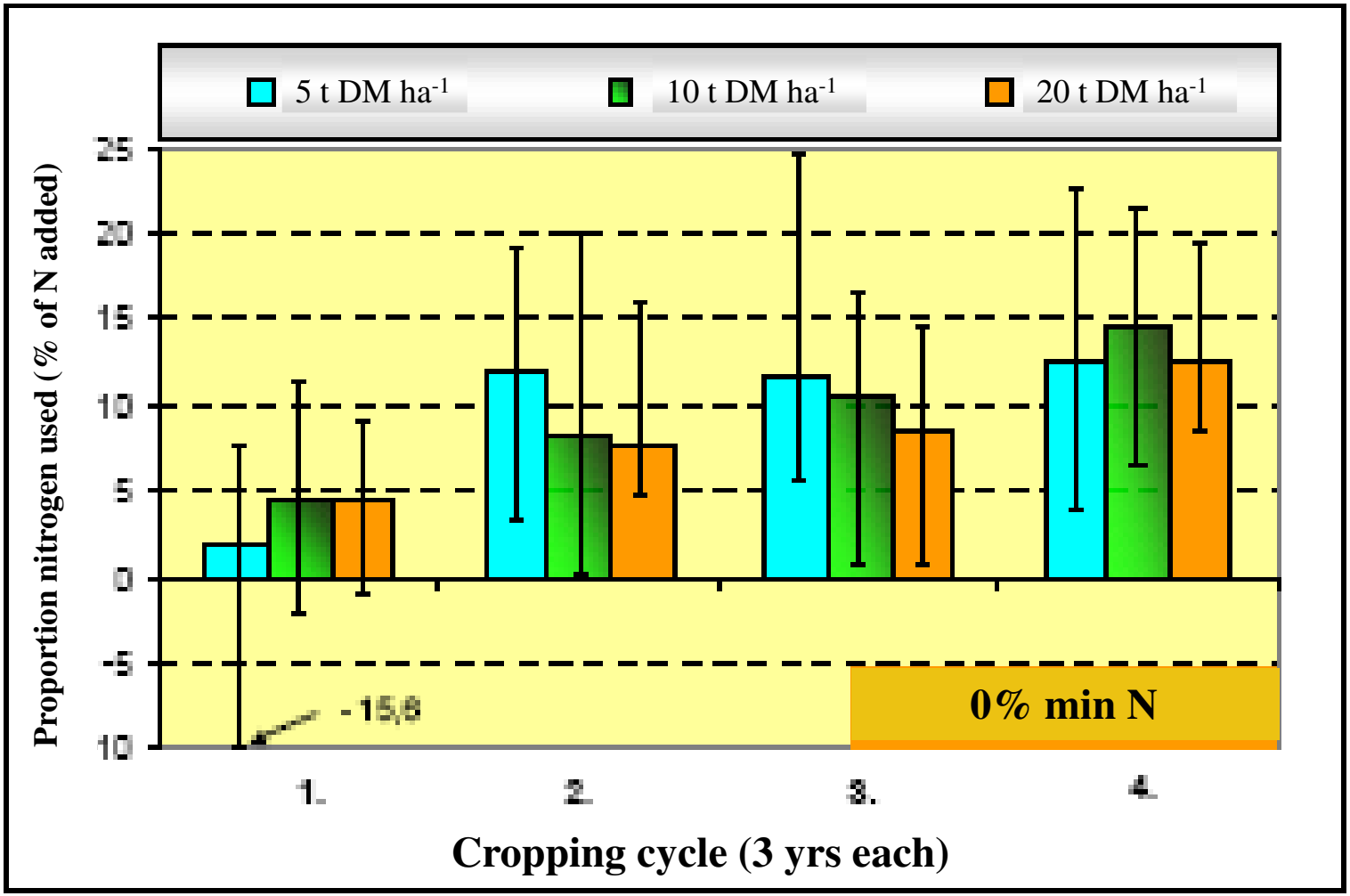
Compost can replace P, K & Mg fertiliser and substitute liming

Nitrogen Use Efficiency

- Generally: 5 – 10% uptake of added N
- < 5% during initial 3 - 4 yrs
- 5 – 15% if compost applied > 4 yrs
- N use efficiency higher (5 – 25%) if no / little use of mineral N
- N use efficiency higher if used for crops with high N demand
- Increase of soil mineral N

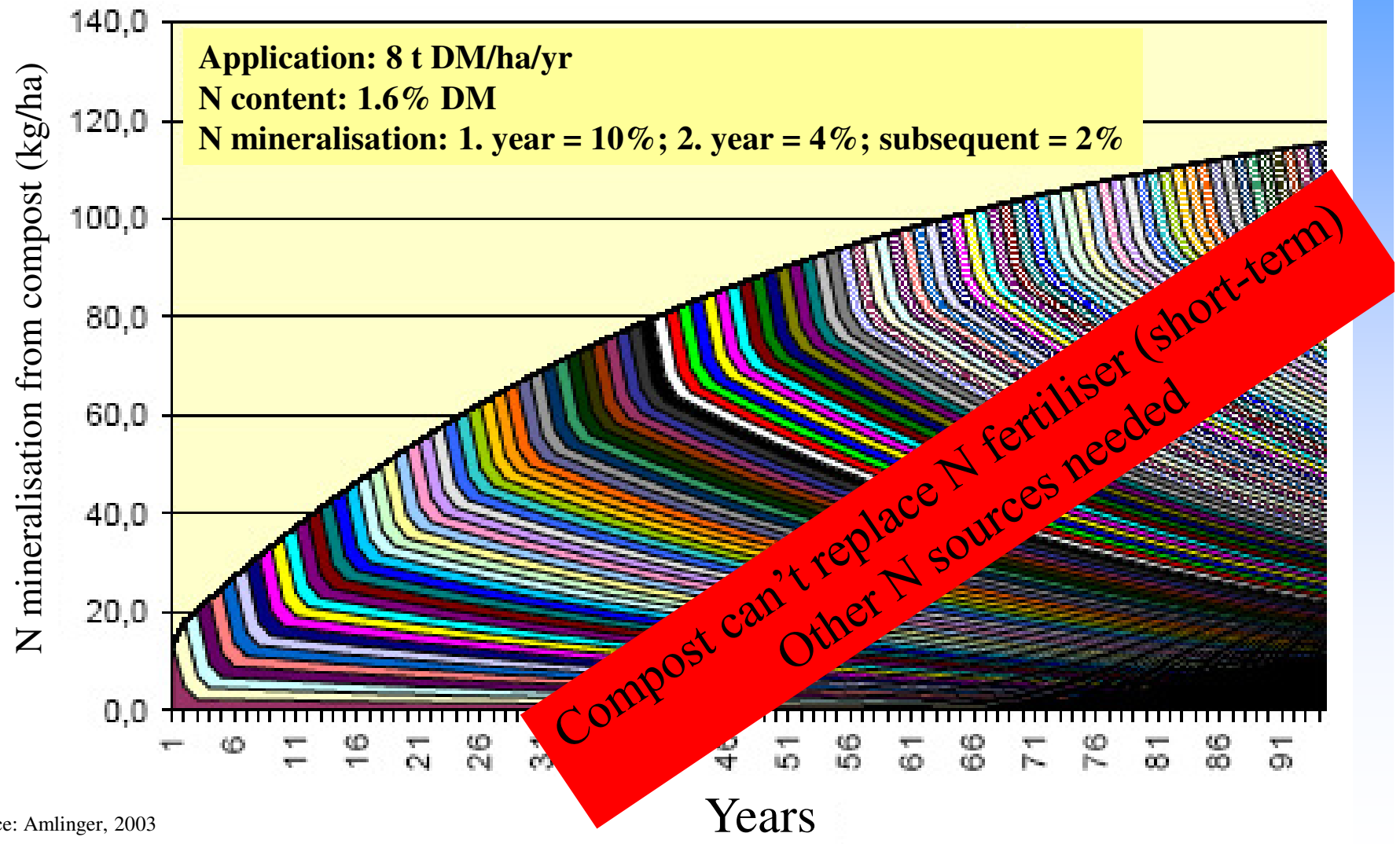
Nitrogen Use Efficiency

12 yrs = 4 cropping cycles



Source: Haber *et al.* 2008

Long-term Nitrogen Supply



Source: Amlinger, 2003

Include Nutrient Supply through Compost Use in your Nutrient Budget

- to see and realise fertiliser savings ($)
- to minimise risks of nutrient deficiencies
- to avert risk of P oversupply
- to prevent environmental problems

Example Nutrient Budget
(sugarcane, 10 t/ha FM compost, 1st year)

	Soil Nutrients (kg/ha)	Nutrients from Compost (kg/ha)			Crop Demand	Nutrient Balance	Fertiliser supplement
	topsoil (15cm)	Total	Avail 1. year		(kg/ha)	(kg/ha)	(kg/ha)
Total N		96.5	10%	6.9			
Nitrate N	5	21.5		21.5	140	-89.1	90
Ammonium N	11	6.5		6.5			
Phosphorus	63	122.1	40%	48.8	30	18.8	0
Potassium	117	102.1	80%	81.7	80	1.7	0
Sulphur	26	23.8	50%	11.9	25	12.4	0
Calcium	2,760	612.8	50%	306.4	1560	-1,254	1,254
Magnesium	612	44.7	30%	13.4	35	590.4	0
Zinc	1.3	2.5	50%	1.25	0.45	2.1	0

Example N Budgeting

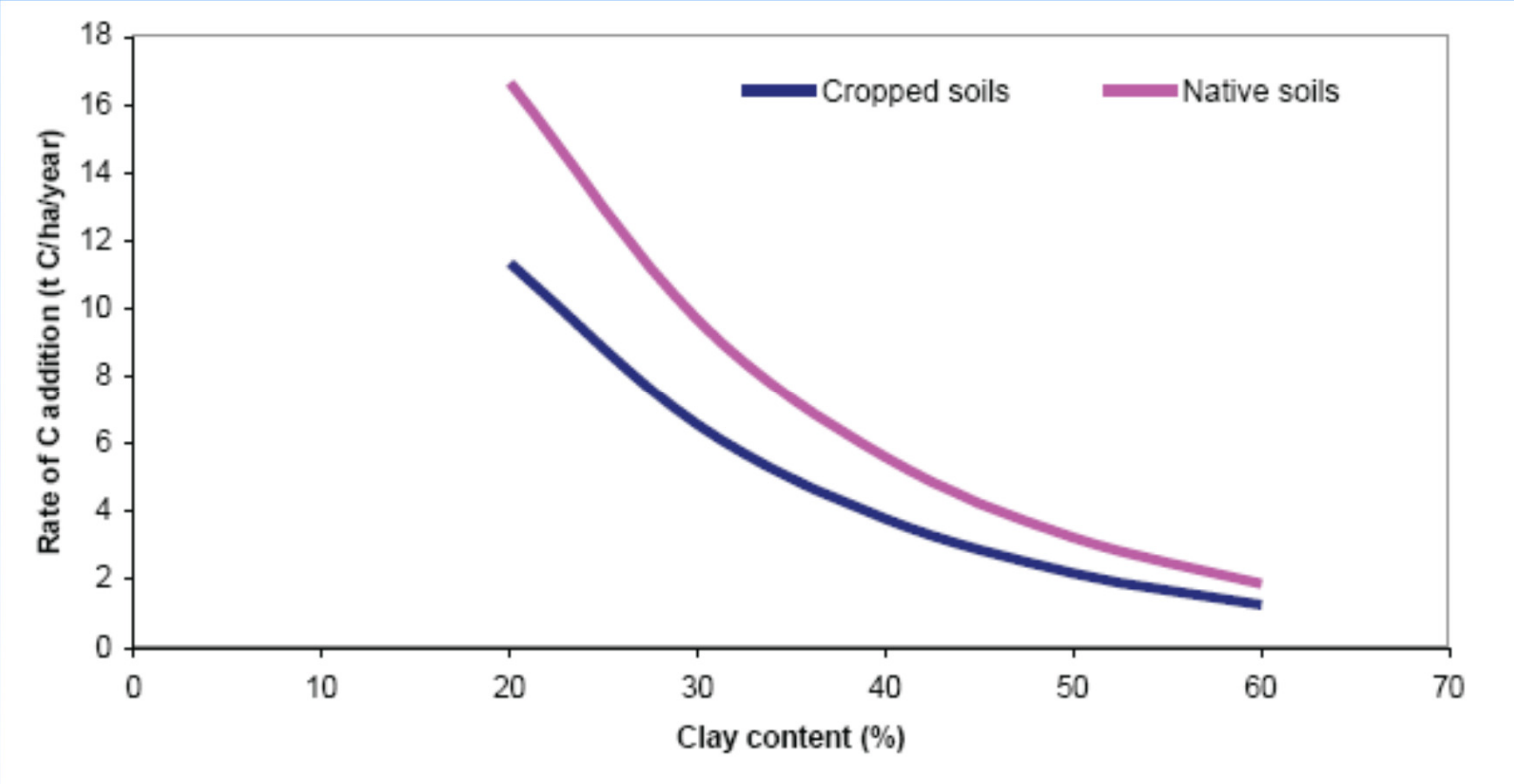
Estimated nitrogen mineralisation rate (% of N_{org})

	1. Qrt	2. Qrt	3. Qrt	4. Qrt	1. Year
Raw chicken manure	10	10	8	5	33
Composted chicken manure	5	4	2	1	12
Raw feedlot manure	8.5	8.5	7	5	29
Composted feedlot manure	3	3	2	1	9

Estimated nitrogen supply (kg/ha)

	Application	1. Qrt	2. Qrt	3. Qrt	4. Qrt	1. Year Total	% Total N
Raw chicken manure	35	7	7	5	3	57	55.8
Composted chicken manure	35	11	9	4	2	61	24.5
Raw feedlot manure	35	56	56	46	33	227	32.5
Composted feedlot manure	35	13	13	9	4	74	15.8

Maintaining Carbon / Humus Levels

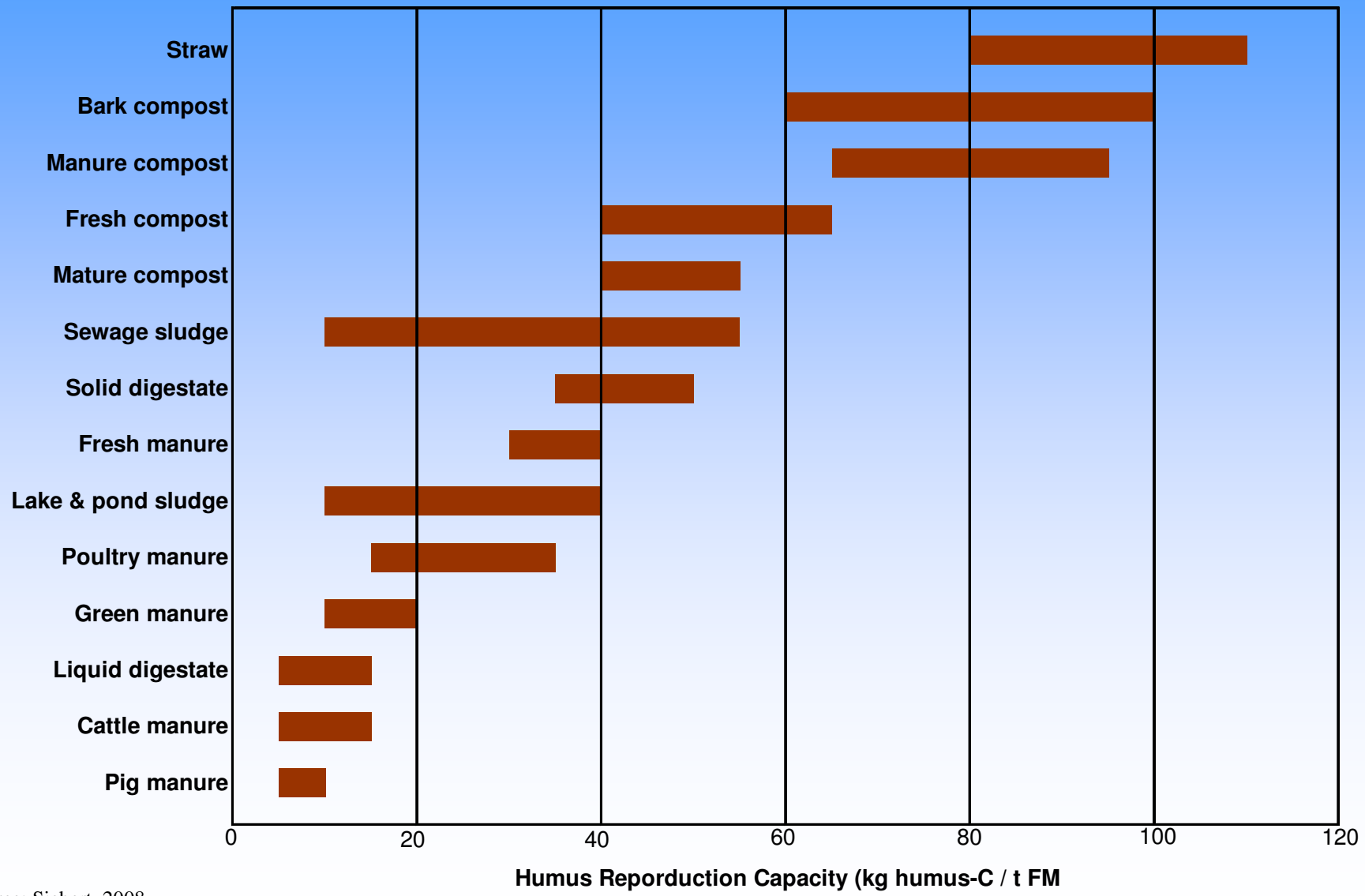


Source: Dalal et al, 2009

Carbon addition required for maintaining carbon levels in cropped and native soils with varying clay content

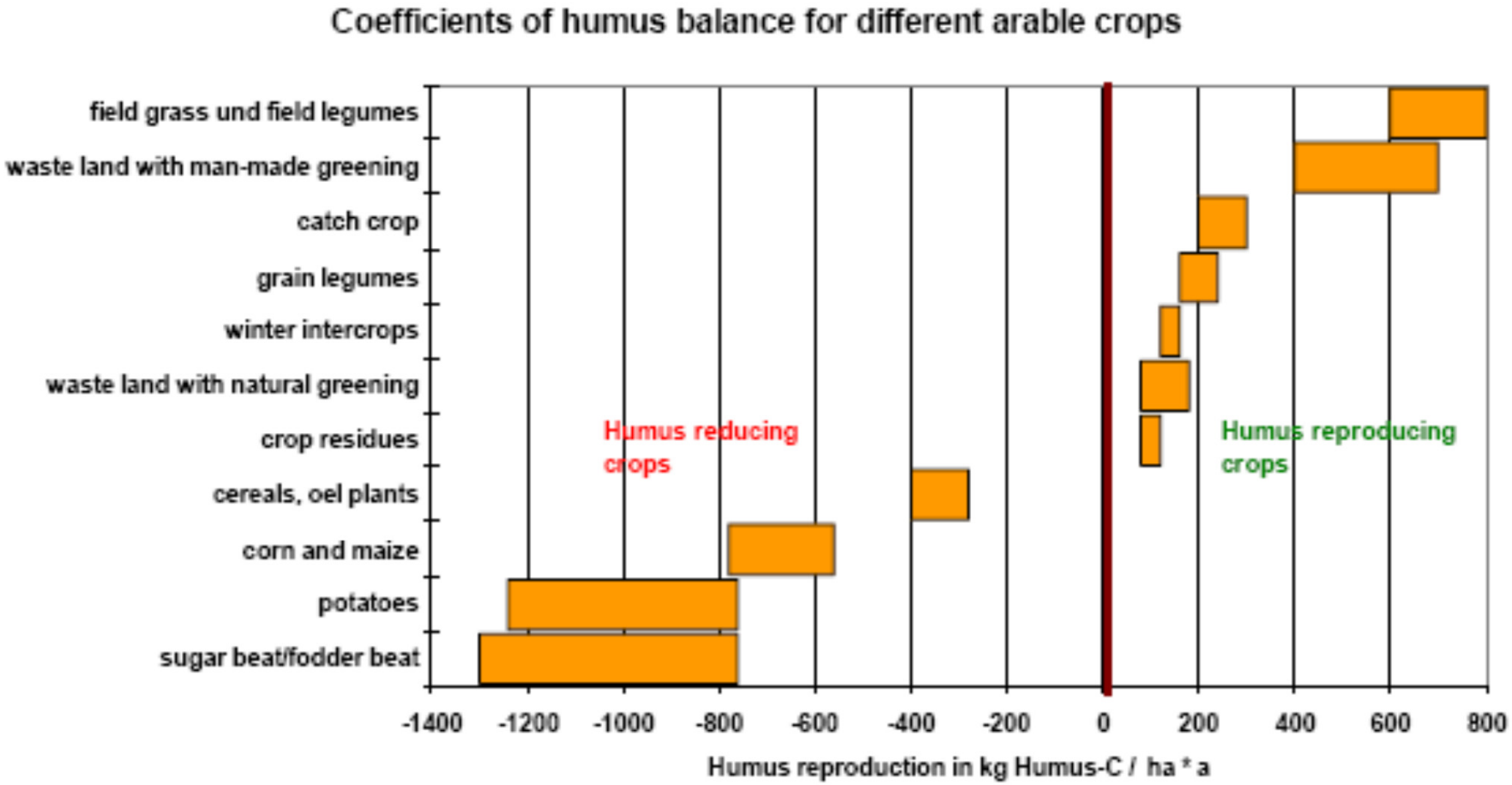
Introducing the concept of a **Humus Budget**

Humus Reproduction Capacity



Source: Siebert, 2008

Effect of Cropping on Humus



Source: Siebert, 2008

Humus Balance

Table 1: Priniple of humus balance

Humus loss		Humus replenishment		Humus balance
Crop specific changes in humus reserves	+	humus-reproduction of organic materials	Amount of organic materials	= humus-nutrition
[kg ha^{-1} a^{-1} humus-C]		[(kg humus-C) (t substrat)$^{-1}$]	[t ha^{-1} a^{-1}]	[kg ha^{-1} a^{-1} humus-C]

Source: Siebert, 2008

Example:
Humus Balance for Crop Rotation

Crop	**kg Humus-C / ha**
Sugar beet	-760 to -1,300 kg
Winter wheat	-280 to -400 kg
Winter wheat	-280 to -400 kg
Total	**-1,320 to - 2,100 kg**
Imports	
Compost (25 t DM in 3 yr)	2,600 kg
Balance (3 years)	**500 - 1,280 kg**

Compost use can help achieve Sustainable Soil Management