The Value of Fertilisers Derived from Human Excreta in Antananarivo, Madagascar

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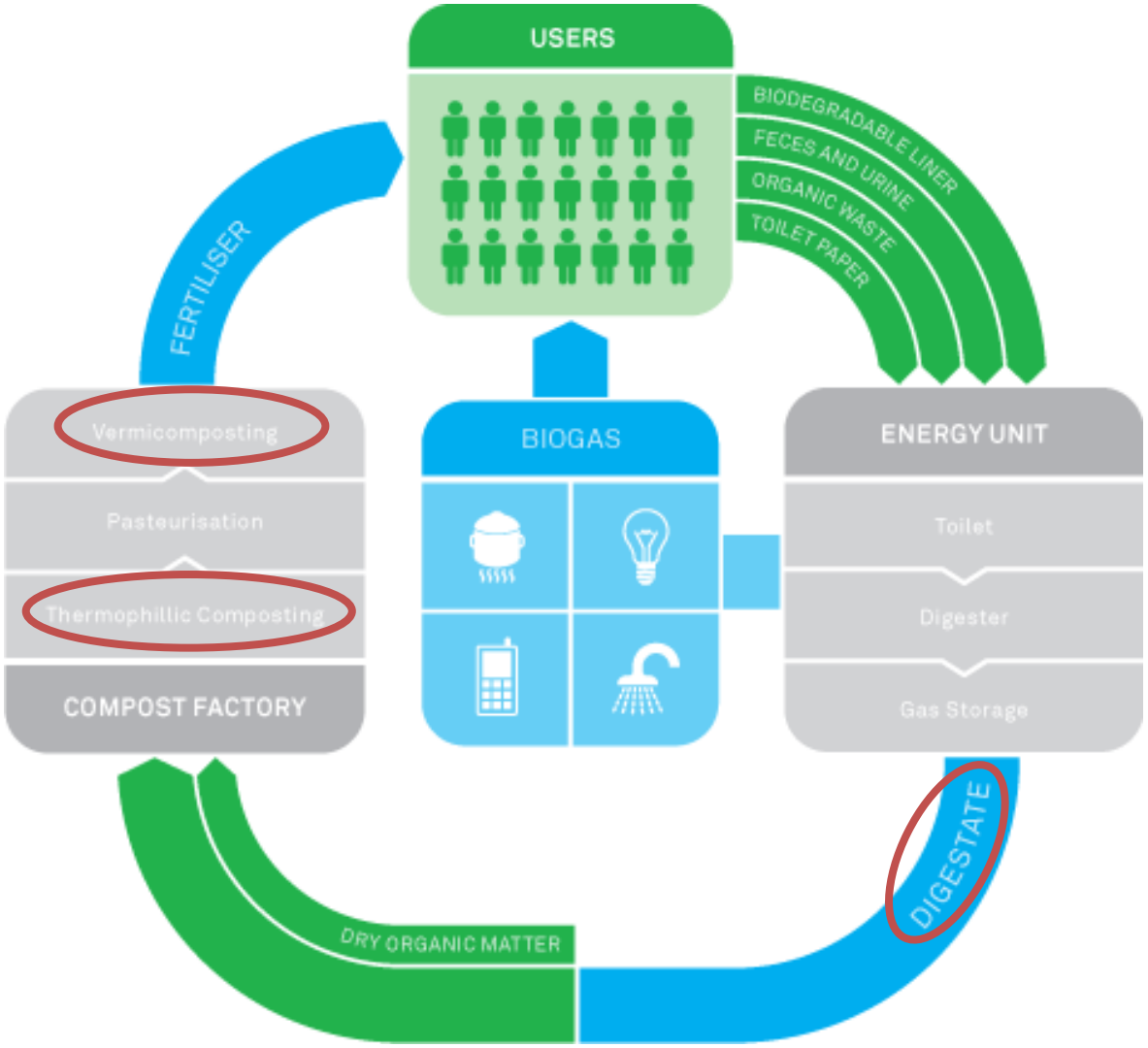
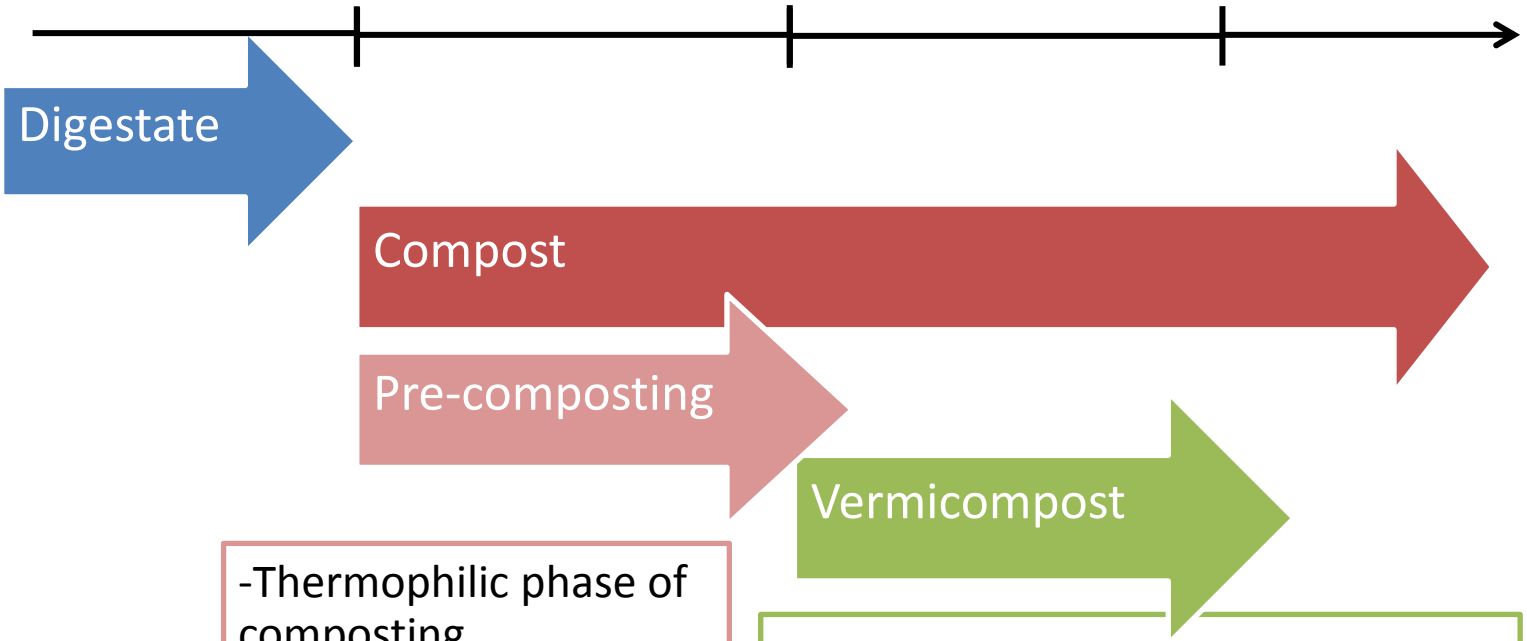
Loowatt's system



Digestion site in Antananarivo

Composting site

From digestate to vermicompost in 2 months



-Thermophilic phase of composting

- Once the compost has reached ambient temperature again it is fed to the worms

-Worms eat their own weight in compost in a day

- Worms digest fresh compost fed to them in 2 weeks

- 2 weeks for further processing, drying and grinding

Loowatt fertilisers

Human excreta + food waste

Digestate

- By-product of anaerobic digestion
- Contains all the nutrients present in the original waste material

Compost

- Biological aerobic process
- Nutrient fixation by organic matter
- Exothermic process that achieves pathogen inactivation

Vermicompost

- Organic matter digested by worms
- Higher micronutrient content

Crop trials using compost and vermicompost derived from human excreta

Glasshouse pot trials at Cranfield University

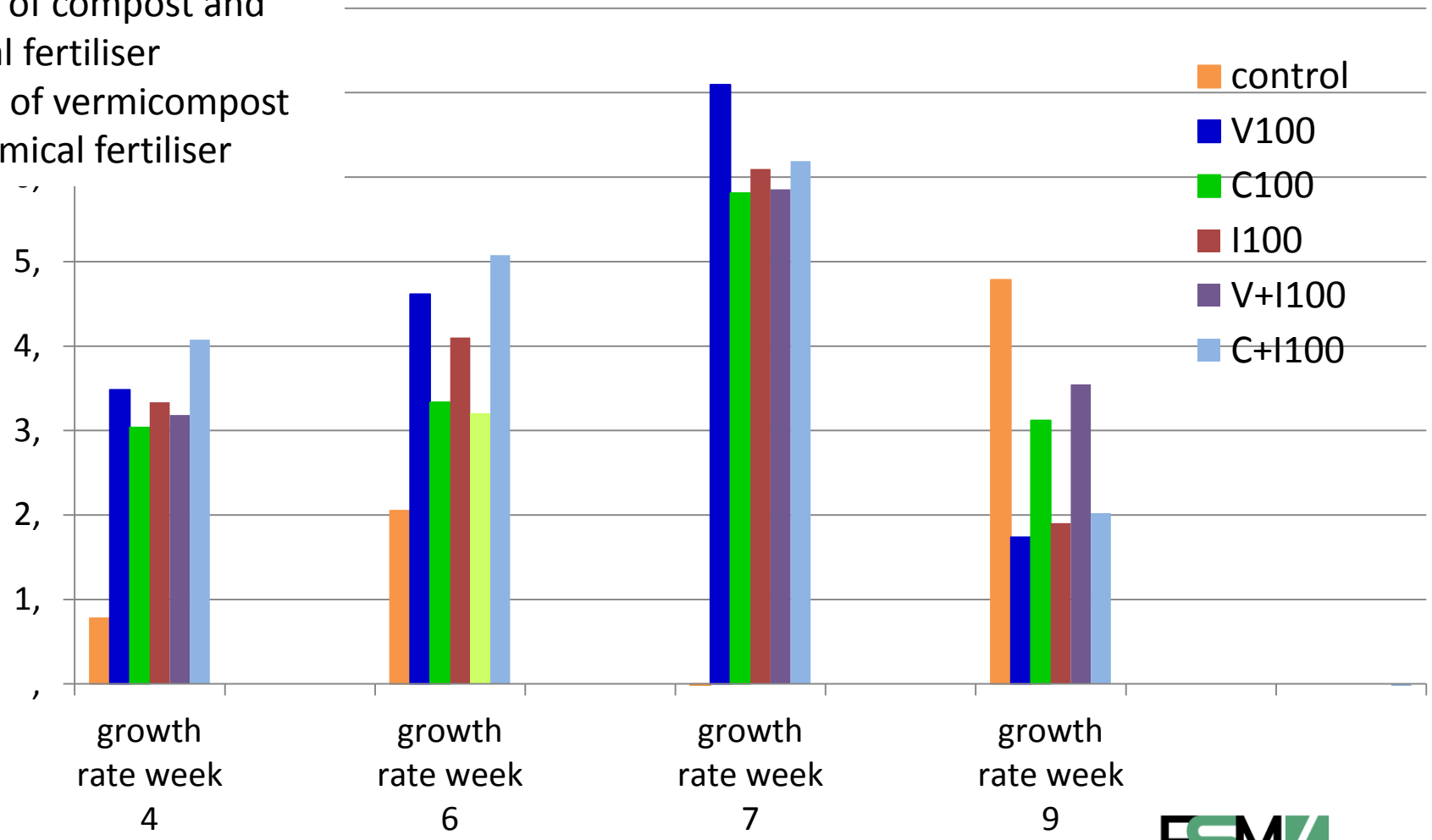
- 5 Treatments applied:
  - Compost (C)
  - Vermicompost (V)
  - Chemical fertiliser (NPK) (I)
  - Mix of compost and NPK (C+I)
  - Mix of vermicompost and NPK (V+I)
- 5 fertiliser application rates
- 3 repetitions
- Randomised pots layout

Initial soil and soil amendments compositions

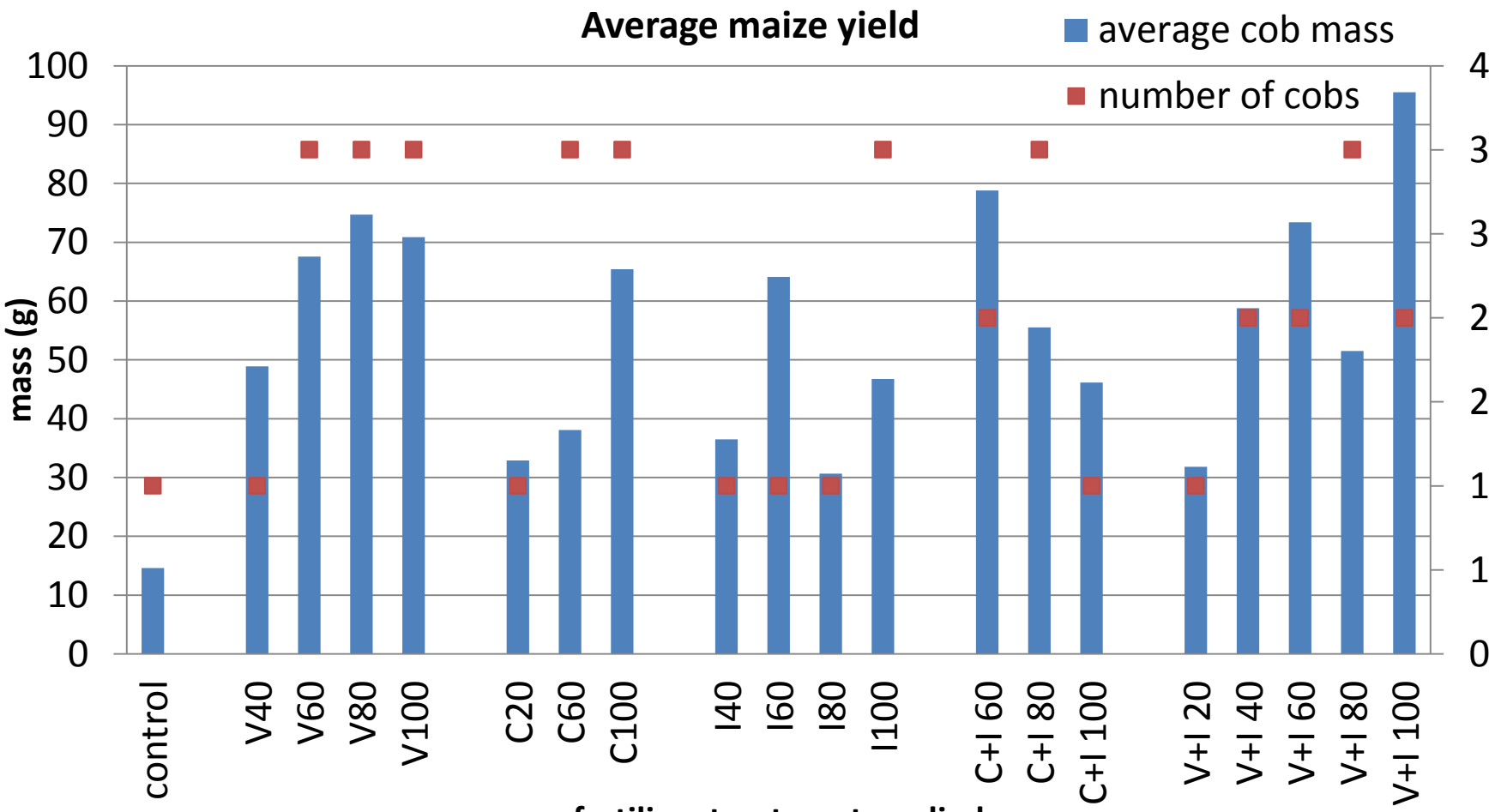
sample	unit	Soil	Compost	Vermicompost
pH		7.93 ± 0.07	9.8 ± 0.15	9.23 ± 0.07
dry matter	%	99.83 ± 0.03	61.13 ± 0.33	89.77 ± 0.33
Total Nitrogen	g/kg	0.1 ± 0	27.8 ± 0.5	22.3 ± 0.1
Nitrate Nitrogen	g/kg	$2.59.10^{-3} \pm 0.09.10^{-3}$	1.95 ± 0.40	0.303 ± 0.04
Ammonium Nitrogen	g/kg	$0.81.\ 10^{-3} \pm 0$	0.333 ± 0.11	0.023 ± 0.001
Total Carbon	% w/w	0.08 ± 0.01	22.67 ± 0.57	19.43 ± 0.23
Available Phosphorus	mg/L	7 ± 0.4	180.33 ± 3.84	215.33 ± 3.71
Available Potassium	g/L	$<20.10^{-3}$	15.96 ± 0.90	15.73 ± 0.4
Available Magnesium	g/L	$<15.10^{-3}$	0.122 ± 0.013	0.224 ± 0.002

Control: no fertiliser applied
V: vermicompost
C: compost
I: chemical fertiliser
C+I: mix of compost and chemical fertiliser
V+I: mix of vermicompost and chemical fertiliser

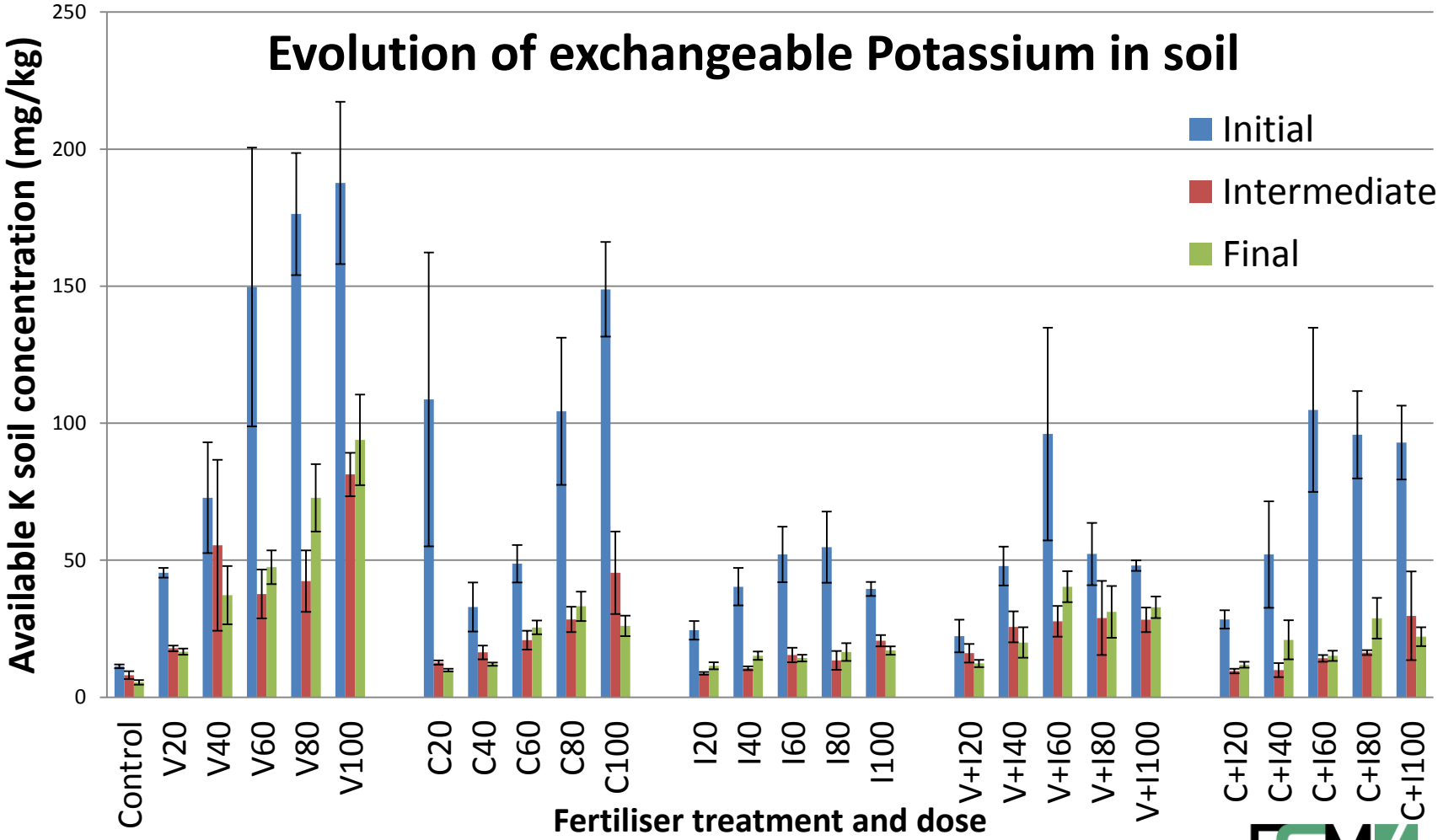
Pot trial plant growth



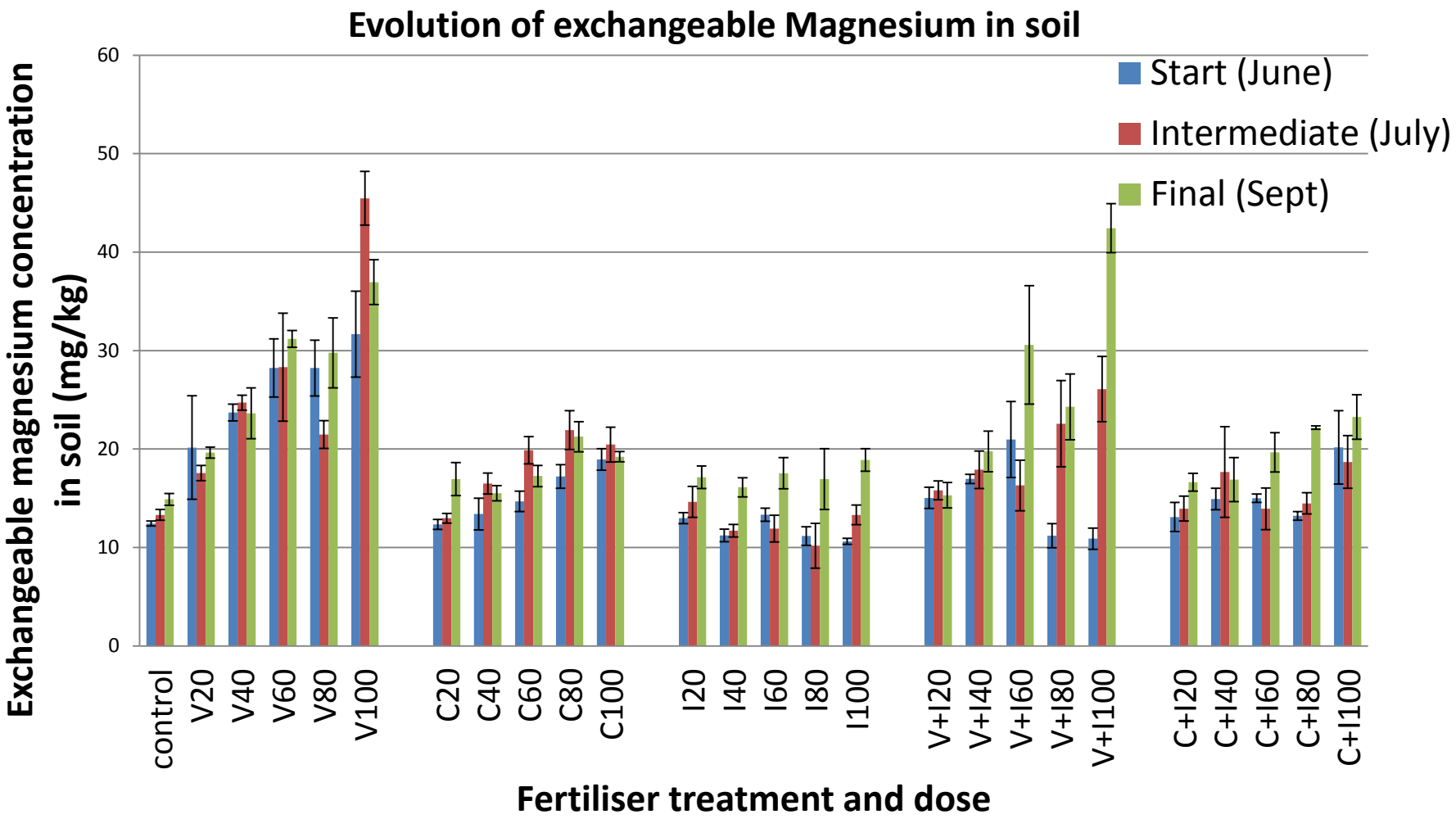
Corn cob harvest



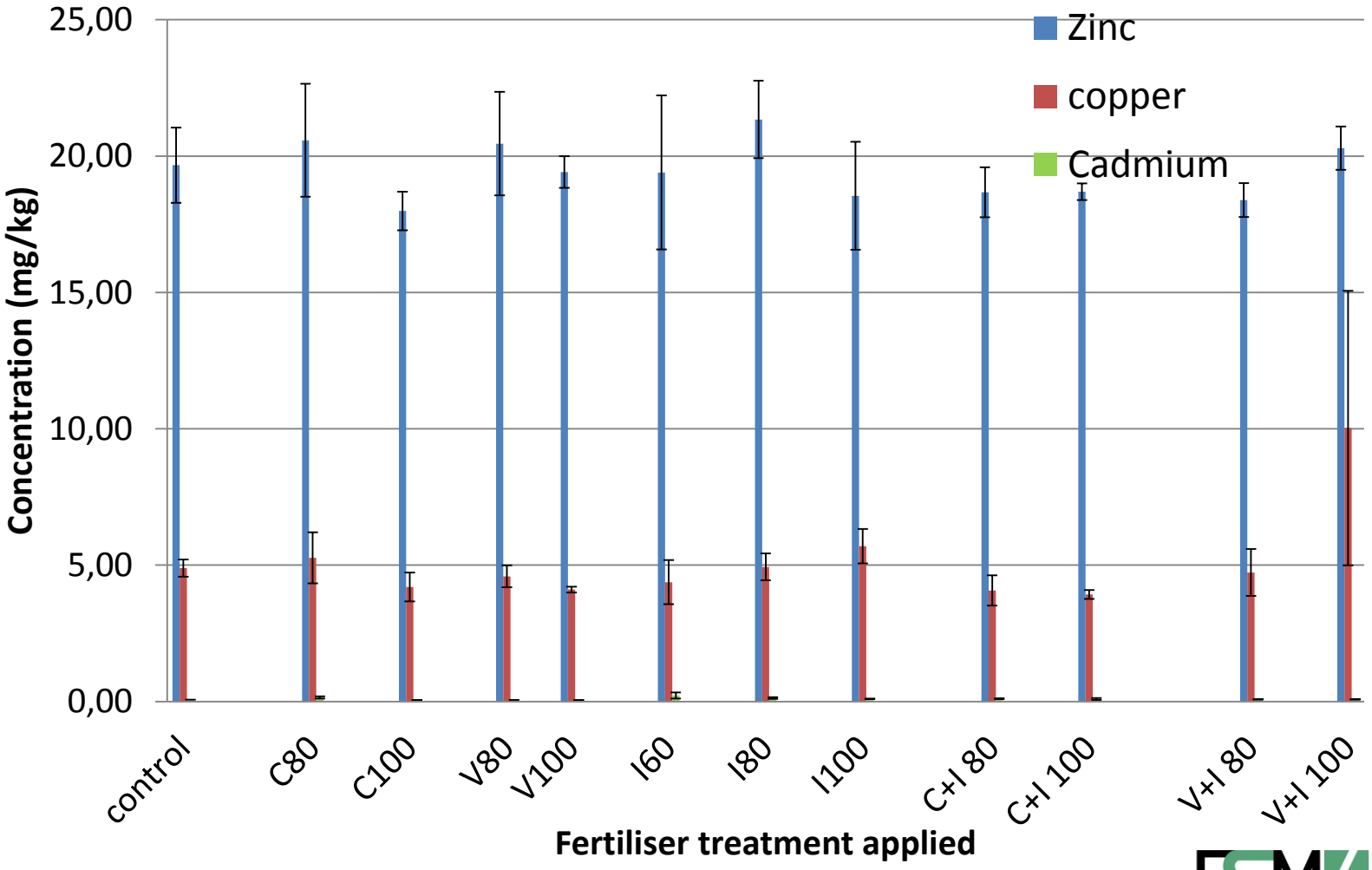
Soil nutrient content evolution



Soil nutrient content evolution



Heavy metal concentrations in soil



Conclusions

- Positive effect on soil and plants for both compost and vermicompost derived from human waste
- Different nutrient content between compost and vermicompost derived from human excreta
- Nutrients in vermicompost are present in more plant- available forms and worms add micronutients to the final product
- Vermicompost is promising: faster production process and higher product value than compost.
- Heavy metals are not a concern for fertilisers produced from source separated human waste