Biomass response of eight traditional South African leafy vegetables grown in the field to rate of manure application

Okorogbona AOM, Van Averbeke W & Azeez JO

Centre for Organic and Smallholder Agriculture
Department of Crop Sciences, Tshwane University of Technology

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Sources of nutrients in smallholder crop production

Mainly organic

Some chemical

Animal manure is the main organic source

- **Mixed farming systems (crop and livestock)**
- **Access to manure from intensive livestock production enterprises**

Manure type	Nitrogen (%)	Phosphorus (%)	Potassium (%)
Poultry	1.0 - 4.0	0.5 - 0.9	0.4 - 2.8
Cattle	0.5 – 2.0	0.1 - 0.6	0.2 – 1.7
Goat	0.8 - 2.5	0.2 – 0.5	1.4 – 4.1

Objective of the study:

To determine the biomass response of selected African leafy vegetables to application rate of three types of animal manure

Treatments:
- 1 control (no fertiliser addition)
- 2 rates of chemical fertilisers
- 6 rates of poultry manure
- 6 rates of cattle manure
- 6 rates of goat manure

Total: 21 treatments

Design:
Completely randomised
6 replications

Treatments

Fertiliser type	Treatment description
Control	No fertiliser addition
Chemical fertiliser	**Medium** 334 kg N ha^{-1}, 219 kg P ha^{-1}, 215 kg K ha^{-1} **High** 668 kg N ha^{-1}, 438 kg P ha^{-1}, 429 kg K ha^{-1}
Promis poultry manure	6 t ha^{-1} – 50 t ha^{-1}
Cattle kraal manure	30 t ha^{-1} – 210 t ha^{-1}
Goat kraal manure	30 t ha^{-1} – 210 t ha^{-1}

Seven litre pot and tray

-Low fertility soil

N (NH_4^+ and NO_3^- combined) : 5.0 mg N kg^{-1} soil
P (Ambic extraction) : 3.6 mg P kg^{-1} soil
K (1M NH_4^+ -acetate extraction) : 19.1 mg K kg^{-1} soil

-Chemical fertilisers

Lime stone ammonium nitrate : 28% N
Super phosphate : 8.3% P
Potassium chloride : 50% K

-Animal manure

Promis (poultry layer litter): 3.71% N, 0.47% P, 1.79% K
Cattle kraal manure: 1.70% N, 0.42% P, 1.68% K
Goat kraal manure: 2.22% N, 0.43% P, 4.02% K

(CON=control; MCF=medium chemical fertiliser; HCF=high chemical fertiliser); treatment means followed by different letters differed significantly ($p \leq 0.05$)

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Summary of results:

Performance of fertilisers

Type of fertiliser	Chinese cabbage	Pumpkin	Amaranth	Nightshade	Mean
Chemical	100	100	100	100	100
Poultry	47	57	71	74	62
Cattle	77	86	96	80	85
Goat	25	48	36	52	40

Summary of results:

Best performing treatments

Type of fertiliser	Chinese cabbage	Pumpkin	Amaranth	Nightshade
Chemical	Medium	Medium	High	Medium
Promis (t ha^{-1})	24	12	18	24
Cattle manure (t ha^{-1})	210	180	180	180
Goat manure (t ha^{-1})	90	60	90	90

CONCLUSION

- Amendment of the low fertility soil with animal manure increased biomass production of all leafy vegetables.
- Apparent optima were identified.
- The cattle kraal manure could be safely applied at very high rates (up to 180 t ha^{-1} in this study) with positive results.
- Poultry manure should not be applied at high rates (less than 12 t ha^{-1} in this study).
- The goat kraal manure was a poor quality fertiliser, apparently because of its high salt content .