The 5th International Symposium on Ecologically Sound Fertilization Strategies for Field Vegetable Production

Manure in the Netherlands, an important input in sustainable vegetable production

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BACKGROUND

Manure is an important input in sustainable vegetable production

- For farmer
  - (Cheap) nutrient source
  - Organic matter source to maintain soil fertility
  - Improve crop yields and financial return
- For society
  - Closing nutrient and carbon cycles
  - Reducing greenhouse gas emissions
  - Improving water quality

Manure production in NL

- Surplus of slurry in the Netherlands
  - Negative prices slurry
- Yearly production 170 Mkg P_20_5
  - Average 90 kg/ha

Manure use in vegetables in NL

- Maximum use of organic fertilizers within legislation
- Preference for manures with high organic matter content

VALUE OF SLURRY

Nutrients organic matter and disposal costs/revenues

- Animal farmers have to pay vegetable farmers to dispose slurry
- Value of organic matter in manure established in long term experiment on sandy soils with different inputs of organic matter from manure. Value is indicative and only valid for sandy soils.

Table 1. Value of cattle and pig slurry in the Netherlands based on disposal costs (revenues for vegetable farmer), value of nutrients in manure (NPK) and the value of organic matter in manure. Costs per hectare are based on input of 60 kg P_2O_5 with manure, this means 40 tons/ha cattle slurry and 13 tons/ha pig slurry (see table 2 for nutrient levels).

	Cattle slurry	Pig slurry
Manure disposal revenues per ton	€ 0-10	€ 10-20
Value of nutrients in manure per ton	€ 10	€ 13
Values of organic matter in manure	€ 36	€ 10
Total value per ton	**€ 46-56**	**€ 33-43**
Total value per ha	**€ 1840-2240**	**€ 430-560**

RESULTS

Right application: prevention of ammonia volatilization

Injection of manure is method with lowest emissions

Application technique	NH3-volatilization (% Nm)
Surface spreading	75-80%
Surface spreading + incorporation	20-30%
Injection	≤5%

SELECTION OF MANURE TYPE

Proper application of manure important

4 R's of nutrient stewardship + 1

- Right source: match manure type to crop needs
- Right rate: match amount to crop needs
- Right time: when crops need them
- Right place: where crops can use them

New

- Right application for maximum efficiency

Appropriate manure for crop needs

- Nutrient content: fertilizer replacement value (Table 2)
  - Nitrogen
    - Slurries: 55-80% of CAN (calcium ammonium nitrate)
    - Solid manures: 30-60% of CAN
    - Compost 10% of CAN
  - Phosphate: 60-100%, (100% long term)
  - Potassium: 100%
- Crop requirements: nutrient ratios e.g. N/P ratio
- Organic matter content: org matter/nutrient ratio e.g. organic matter/P ratio

Table 2. Average composition of some organic manures in the Netherlands (g/kg)

	Total N	% N-NH_3	P_2O_5	K_2O	N/P	Org. matter	Org. matter/P
Slurry (liquid manure)							
Cattle	4.1	49	1.5	5.8	2.7	64	43
Pigs	7.1	65	4.6	5.8	1.5	43	9
Solid manure							
Cattle (on straw)	5.3	17	2.8	6.1	1.9	152	54
Chickens	29	11	24	19	1.2	401	17
Compost							
Household compost	13	0.1	6.3	11	2.0	242	38
Green compost	5.0	0.1	2.2	4.2	2.3	179	81

Table 3. Composition of pig slurry and separate fractions after separation and ultra filtration and reversed osmosis of the liquid fraction.

	OM	N tot.	N-NH_3	P_2O_5	N-tot./ P_2O_5
Input slurry	45	7.0	60%	4.0	1.8
Separation (high efficiency technique)					
Solid fraction	146	10.5	57%	18.7	0.6
Liquid fraction	25	6.4	58%	1.4	4.5
Ultra filtration and reversed osmoses of the liquid fraction					
Mineral concentrates	17	8.1	90%	0.5	17.3

NEW WAYS TO CHANGE MANURE COMPOSITION

Manure digestion

- Energy production
- Input: manure + co-material
- Output: gas + digestate
- Increase nitrogen replacement value of digestate with 10% compared to input

Manure processing

- Separation of slurry + Reversed osmosis
- Output (Table 3)
  - Solid fraction (organic matter and P-rich soil improver)
  - Mineral concentrate (N-K fertilizer with low P and organic matter content)
  - Permeate

CONCLUSIONS

Manure is an important input in vegetable production. It contains nutrients and organic matter to fertilize the crop and sustain soil fertility. Use of manure increases crop production and financial return. However for sustainable use proper use and application is important. Select the right manure matching crop needs and apply it with minimum emissions at the right time and place.

New developments are improved placing of manure (row fertilization) and manure processing to better match crop needs.

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