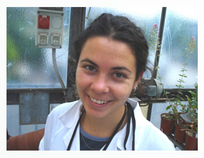
FACULTY OF LIFE SCIENCES
UNIVERSITY OF COPENHAGEN

agrinatura
The European Alliance on Agricultural Knowledge for Development

Organic Extracts: Potential for Fertilization and Relevance of Use in Tropical Countries

Elena Gioseffi[1], Bino Leonardi[2], Francesco Giuffrida[2] and Andreas de Neergaard[1]

[1] Department of Agriculture and Ecology, Faculty of Life Sciences, University of Copenhagen, Denmark
[2] Department of Horticulture & Food Technology, University of Catania, Italy
✉ elenag@life.ku.dk



Background

Vegetable production can play an important role in improving livelihoods of resource-poor farmers in tropical countries. In vegetable fertilization, nitrogen (N) is one of the most important nutrients. However, chemical N fertilizers are becoming more expensive and often out of reach for smallholders, and common organic fertilizers have a slow nutrient release compared to these. Therefore, farmers need a quick-acting and cheap N fertilizer suitable for vegetable production. Organic extracts are widely used in many tropical countries as top-dressing fertilizer, but few scientific studies have been made to understand their effectiveness.

How is the use of organic extracts a relevant and potential N resource for small-scale vegetable fertilization in tropical countries and how are they currently produced and used?

Summary of findings

- Total N recovery in extracts from crop residues was 24-31% of total plant N added
- The mineral N fraction was dominated by ammonium
- The concentration of most macronutrients was high compared to a commercial fertigation solution, except for phosphorus
- Extracts contained high amounts of salts, provoking salinity stress in plants
- The use of organic extracts to be used as a quick-acting fertilizer is a very relevant option for resource-poor vegetable producers in Cambodia
- The main perceived advantages by farmers of the use of organic extracts are acceleration of crop growth, easy production and use, availability at almost zero cost. Socio-cultural factors also have an influence (environmental and health awareness)
- Diverse means of preparation: materials are chosen in accordance with availability while preparation time and application methods vary

Experimental trials in Italy

Objectives

✓To study the dynamics of N mineralization and release during extraction process, with different plant materials
✓To test the fertilizing value of liquid extracts used as fertigation on a crop

Methodology

✓3-week extraction experiment in water using crop residues:
- Cabbage leaves (*Brassica oleracea* var.botritis)
- Tomato leaves (*Lycopersicon esculentum*)
- Tomato whole residue (leaves+stem+part of roots)

✓Greenhouse trial with lettuce

Plant materials released N to solutions at different rates, particularly regarding the mineral N fraction of soluble N.

Table 1. Nitrogen recovery in extract solutions

Material	C:N ratio	Total soluble N: % of total plant N added	Total soluble N: Obtainable with 1 t of fresh material* (kg N)	Mineral N: % of total plant N added	Mineral N: % of total soluble N	Mineral N: Obtainable with 1 t of fresh material* (kg N)
Cabbage leaves	10.1	31.2	25.0	8.1	26.0	6.5
Tomato leaves	11.8	24.4	34.2	15.0	61.5	21.0
Tomato plant	17.6	31.0	43.4	15.4	49.7	21.6

* Assuming a relative water content of 92% for cabbage leaves, and 86% for tomato leaves and tomato plant

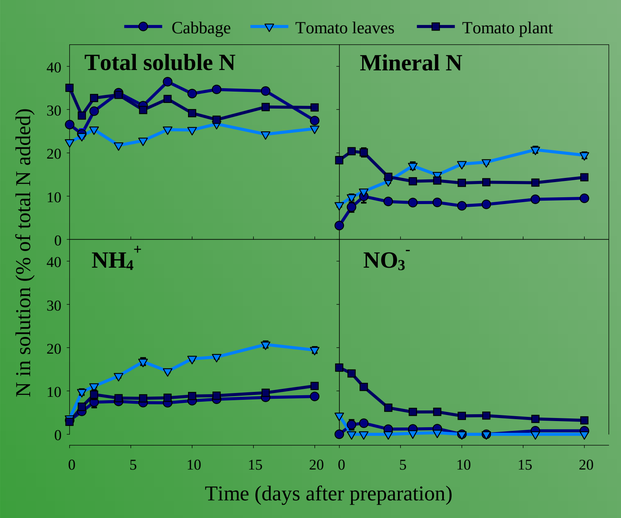


Figure 1. Nitrogen release in solution during 21 days (n=3)

Ammonium (NH_4^+) was the dominant form of mineral N in the extracts, while nitrate (NO_3^-) tended to disappear from the system. Extracts contained other nutrients in high concentrations, often much higher than the mineral control (a mineral fertigation solution), except for phosphorus.

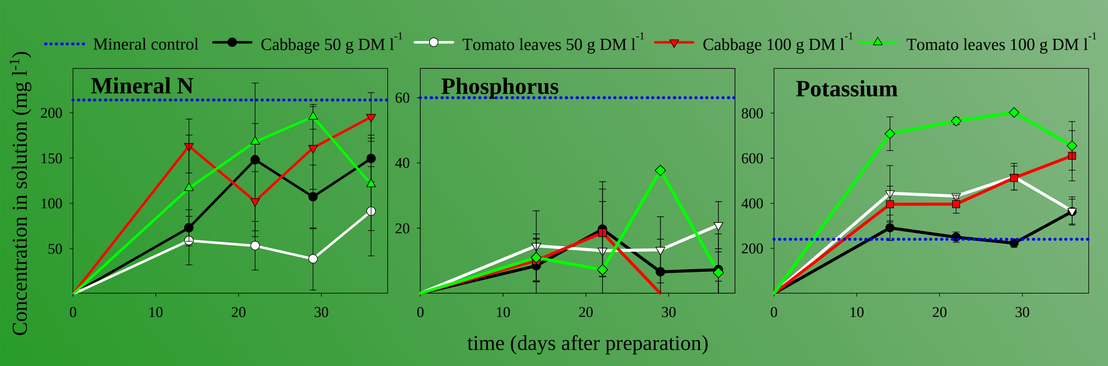


Figure 2. Mineral nitrogen, phosphorus and potassium content in extract solutions used for lettuce (n=3)

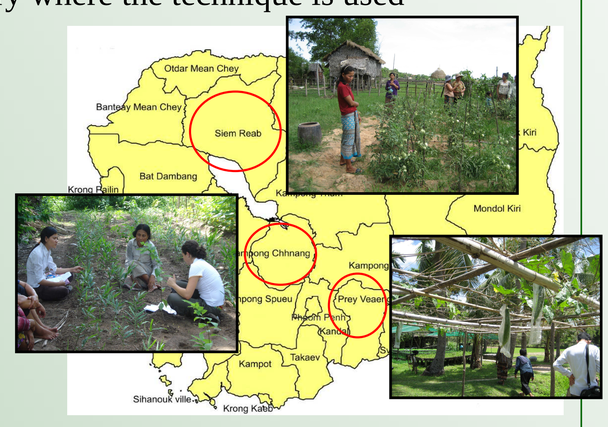
Qualitative Research in Cambodia

Objectives

✓To understand the relevance of organic extracts for vegetable fertilization in developing countries
✓To collect information on preparation and use of organic extracts for fertilization in a country where the technique is used

Methodology

✓Questionnaire surveys
✓Loosely- and semi-structured interviews
✓Direct observation
✓Review of secondary sources



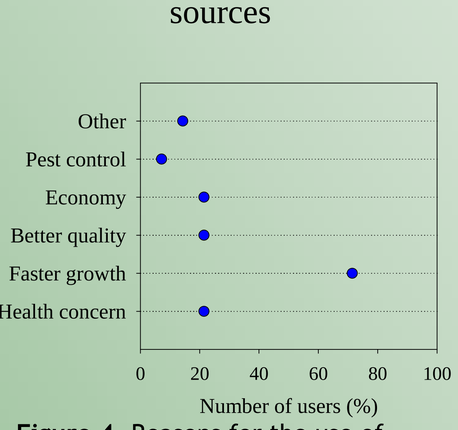


Figure 4. Reasons for the use of liquid compost

In Cambodia organic extracts are called ”liquid compost”. About 50% of the total respondents use this type of fertilizer in addition to other fertilizers. Most farmers observe that the application of these extracts results in higher and better quality production.

Results

Application is either foliar or as a soil drench. The materials used are collected in the farm or in its vicinity and they are both animal and plant derived. Preparation time is about 2-3 weeks. Extracts are always diluted 10-40 times.

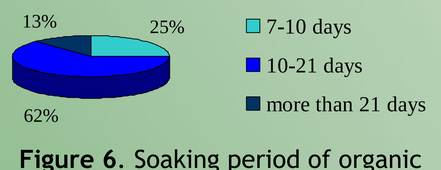


Figure 6. Soaking period of organic materials before use as liquid compost

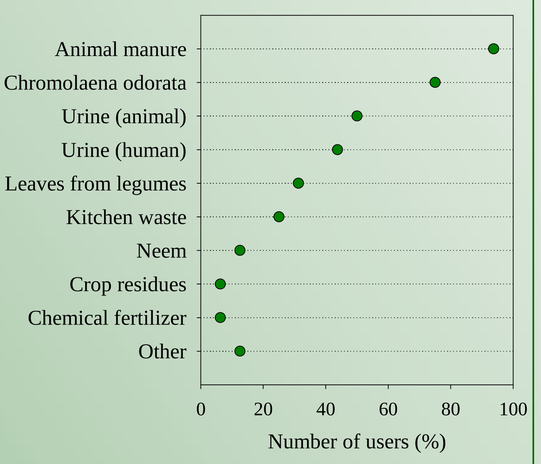


Figure 5. Materials used to prepare liquid compost

The extracts contained high levels of salts, especially Sodium and Chlorine, resulting in high salinity stress in lettuce plants after application.

Figure 3. Effect of salinity on lettuce growth

Acknowledgments

The participation of the main author to Tropentag 2009 has been supported by a NATURA travel grant