

An efficient method for organic greenhouse production in Norway



Michèl J. Verheul

Norwegian Institute for Agricultural and Environmental Research

Problems with soil-borne diseases in organic greenhouse production can be avoided by crop rotation. In modern greenhouse production, with producers specialized in production of tomatoes (*Solanum lycopersicum*) or cucumbers (*Cucumis sativus*), this is often not an option. A more practical method instead of crop rotation might be the use of soil rotation.

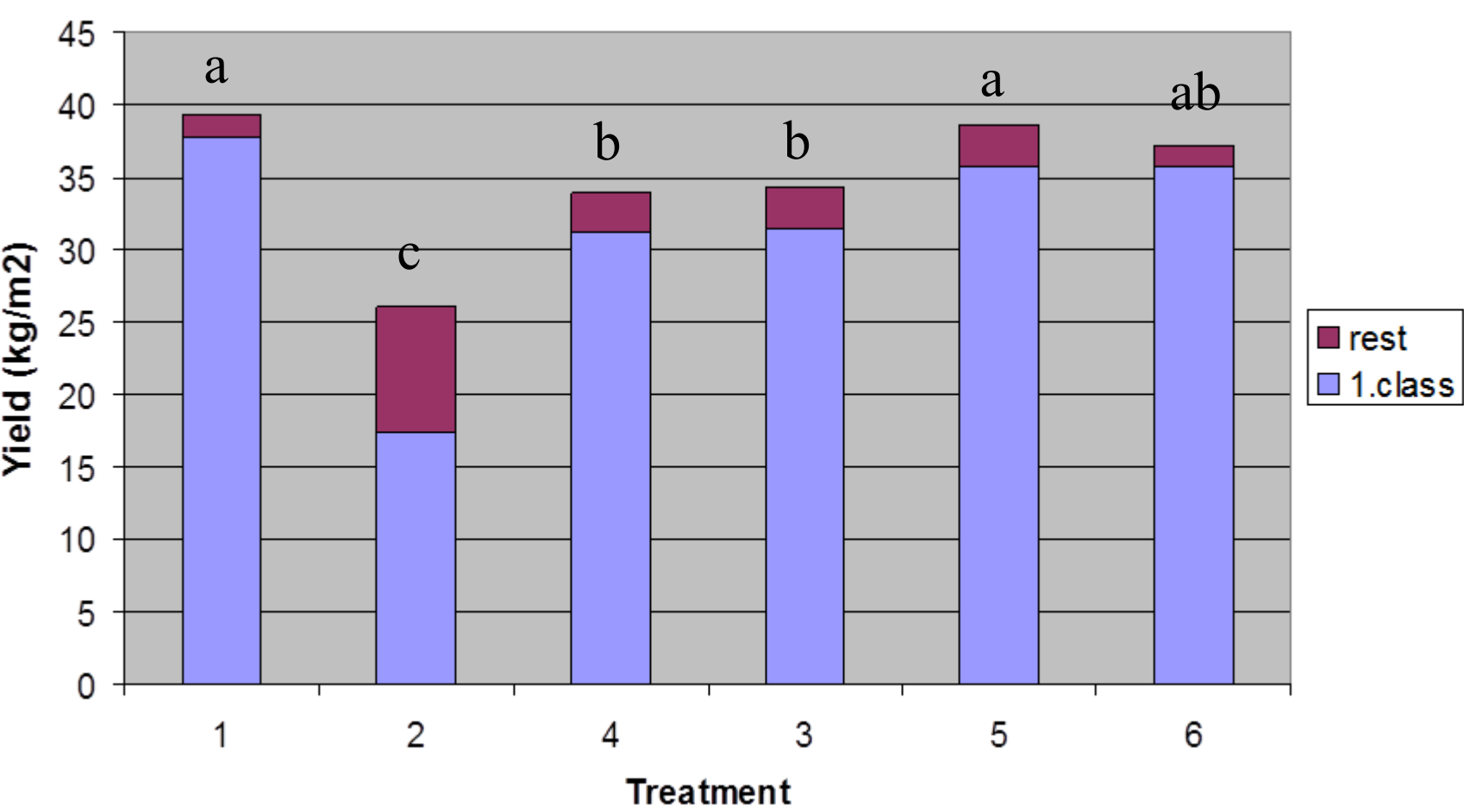
Methods

Plants were grown in limited beds containing a growth medium based on different plant- and/or animal-based composted materials combined with peat. Solid and liquid plant- or animal-based organic fertilizers were added frequently in accordance with the requirements of the plants during the growing season. The nutrient content of the organic fertilizers was analyzed before use.

	Soil	Limited bed
Soil borne pests and diseases	Sterilization Crop rotation	Soil recycling
Transitioning	1,5-5 years More difficult	0 year Easy
Application of fertilizer and leaching	Less controlled	Controlled
Rooting volume	Large	Limited

Results

Tomato production



Yield of tomato (kg m⁻² year⁻¹) using different growth media and fertilizers:

- Standard peat bags (25 L m⁻²) with added standard liquid inorganic fertilizer (750 L m⁻², EC=2.0) using standard drip irrigation (Control treatment).
- Standard peat bags (25 L m⁻²) with dried chicken manure (2 kg m⁻²) and added liquid seaweed extract (750 L m⁻², EC=0.5) using standard drip irrigation. Blood meal (15 g m⁻²) was added seven times during the growing season.
- A mixture of peat and perlite (80/20 volume %, 75 L m⁻² in a drainage tube with a diameter of 50 cm, cut in two) with dolomite meal (125 g m⁻²) and added cattle slurry (0.5 L m⁻², 3 times a week, total of 24 L m⁻²) using a can and sprinkler irrigation.
- A commercial organic substrate ("Turvemulta", Biolan Oy, Finland, 75 L m⁻² in a drainage tube with a diameter of 50 cm, cut in two) with dried chicken manure (2 kg m⁻²) and added liquid seaweed extract (750 L m⁻², EC=0.5) using standard drip irrigation. Blood meal (15 g m⁻²) was added seven times during the growing season.
- A commercial organic substrate ("Turvemulta", Biolan Oy, Finland, 75 L m⁻² in a tube with a diameter of 50 cm, cut in two) with dried chicken manure (2 kg m⁻²) and added cattle slurry (0.5 L m⁻², 3 times a week, total of 24 L m⁻²) using a can and sprinkler irrigation.
- A mixture of organic soil and perlite (80/20 volume %, 75 L m⁻² in a tube with a diameter of 50 cm, cut in two) with composted pig manure (8 kg m⁻²) and added cattle slurry (0.5 L m⁻², 3 times a week, total of 24 L m⁻²) using a can and sprinkler irrigation.

Plants were grown in accordance to standard commercial tomato production in Norway with respect to growing conditions and harvested before the 30th of October. Irrigation, with a fixed amount of 4 dl m⁻² each turn, was controlled by light integration. Each treatment was repeated four times.



Treat ment	Nitrogen use (g kg ⁻¹ of tomatoes harvested)
1	2.5
2	3.7
4	3.6
3	2.5
5	2.7
6	2.9

Cucumber production



Yield (kg m ⁻²)	Planting 1 (week 9) with harvesting in week 12-21 (9 weeks)	Planting 2 (week 21) with harvesting in week 24-32 (10 weeks)	Planting 3 (week 33) with harvesting in week 36-44 (7 weeks)	Sum
Lowest	6.5	11.2	3.4	21.1
Highest	19.9	23.0	7.6	50.5

Highest yields were achieved using:

- Growth medium: based on peat, not replaced between plantings.
- Basic fertilizer: chicken manure, 4.5 kg m⁻². A further increase to 9 kg m⁻² had little effect on yield.
- Liquid fertilizer: Vinasse, EC = 1.2
- With recirculation of drainage water using a biological filter



Soil rotation

After the growing season, the growth medium was composted for one year and re-used as an organic growth medium in the following growing season with good results. High composting temperatures (>55°C) and frequent turning and watering were applied to ensure good compost quality and to reduce the development of soil borne pests and diseases.

Use of a growth medium based on composted waste from organic tomato production resulted in high yields in a cucumber production using artificial light (2.5 kg m⁻² week⁻¹ in the harvesting period).



Conclusion

The method of soil rotation using optimal combinations of growth medium and organic fertilizer resulted in high yields, of approximately 85-95% when compared with conventional production. Results were confirmed in commercial greenhouse production.

References

- Verheul, M.J. (2005). A rational growing system for organic production of greenhouse tomatoes. Proceedings NJF-seminar 369. Organic farming for a new millenium- status and future challenges. Allnarp, Sweden, June 15-17, 2005.
- Verheul, M.J (2008). Profitable production of organic greenhouse vegetables in Norway. Gartneryrket 5 (2008), 34-39 (in Norwegian).