



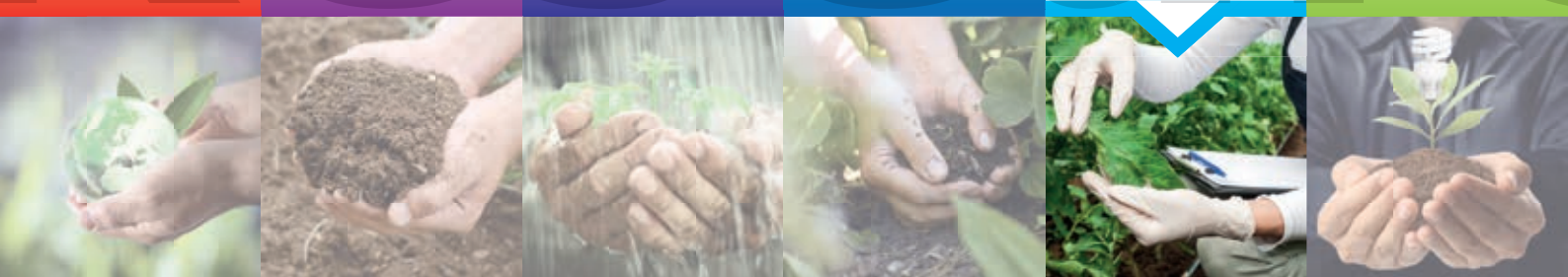
Guidelines for Experimental Practice in Organic Greenhouse Horticulture

Edited by Martin Koller, Francis Rayns, Stella Cubison and Ulrich Schmutz



COST is supported by
the EU Framework Programme
Horizon 2020

Research





The Editorial Board This picture was taken at the final meeting to discuss these guidelines, held in Tori, Estonia in September 2015. A commercial organic greenhouse with a tomato crop is shown in the background. Left to Right: Pedro Gomez, Stella Cubison, Wolfgang Palme, Justine Dewitte, Martin Koller, Yüksel Tüzel, Francis Rayns, Ingrid Bender and Ulrich Schmutz.

Correct citation of this document:

Koller, M., Rayns, F., Cubison, S. and Schmutz, U. (Editors) 2016. Guidelines for Experimental Practice in Organic Greenhouse Horticulture. BioGreenhouse COST Action FA 1105, www.biogreenhouse.org.

ISBN: 978-94-6257-534-9

DOI (Digital Object Identifier): <http://dx.doi.org/10.18174/373581>

The guidelines were initially based on the following publication with many new chapters contributed by European and international authors:

Lindner, Ulrike and Billmann, Bettina (Eds.) 2006. Planung, Anlage und Auswertung von Versuchen im Ökologischen Gemüsebau. Handbuch für die Versuchsanstellung ["Planning, Setup and Evaluation of Trials on Organic Vegetable Cultivation. An Experimental Design Manual"]. Forschungsinstitut für biologischen Landbau (FiBL), Frick, Schweiz und Frankfurt, Deutschland, ISBN 978-3-906081-97-7, <http://orgprints.org/9863>.

Pictures

All pictures are by members of the Biogreenhouse COST Action FA1105. Contributors to the pictures (in alphabetical order) are: Ingrid Bender, Stella Cubison, Justine Dewitte, Pedro Gomez, Martin Koller, Carolyn Mitchell, Jérôme Lambion, Wolfgang Palme, Virginia Pinillos, Ulrich Schmutz, Yüksel Tüzel and Anja Vieweger.

Disclaimer

The information in these guidelines is based on the expert opinions of the various authors. Neither they, nor their employers, can accept any responsibility for loss or damage occurring as a result of following the information contained in these guidelines.

Acknowledgement

This book is based upon work from COST Action FA1105 BioGreenhouse, supported by COST (European Cooperation in Science and Technology).

The authors and editors wish to thank many colleagues for their assistance in providing the material for these guidelines. In addition Rob Meijer (Chair, COST Action FA1105 Biogreenhouse), Karin Postweiler (DLR Rheinpfalz, Germany), Birgit Rascher (LWG Bayern, Germany) and Catherine Mazollier (GRAB, France) provided critical comments on the text. We want to thank Ms. José Frederiks (Wageningen UR Greenhouse Horticulture) for processing layout and printing. We are grateful for financial support and the opportunity to build this network. Link to the Action: http://www.cost.eu/COST_Actions/fa/FA1105 and: <http://www.biogreenhouse.org/>

April 11, 2016

4.6.2 Basil - grown in pots

By Martin Koller and Robert Koch

Botanical name: *Ocimum basilicum*

Crop requirements

There are many different types available, but only the big leaved Genovese type is of significant commercial interest. Beside sweet basil other varieties are cultivated, like Thai basil (*O. basilicum* var. *thrysiflora*), lemon basil (*O. x citriodorum*) and holy basil (*Ocimum tenuiflorum*). Most of the basil types are annual but some can be perennial, e.g. African blue basil (*Ocimum kilimandscharicum* × *basilicum* 'Dark Opal').

Basil has a high warmth and light requirement. The crop is sensitive to wet leaves and should therefore be irrigated from below (e.g. using an ebb-flood system). If experiments are to be conducted in winter in regions with short day length then artificial lighting should be considered (e.g. in Germany an additional 7h lighting with 2000 - 3500 lux). Different types of basil (like red leaf types, small leaf) should be watered separately. This can cause complications in a trial using both types.

The cultivation period depends on the temperature and light; it can vary from 4 weeks in the summer to 9 weeks in the winter (from sowing date to point of sale). Temperatures below 16°C should be avoided, because red-brownish or bright yellow leaf spots may develop. Basil is grown in different pot sizes according to market demand. Smaller pot sizes (9 to 10 cm diameter) are chosen if it is intended for the consumer cut it once or to transplant it. Bigger pot sizes (>12 cm diameter) are used when it is intended that the consumer is will keep it in that pot for several weeks.

Experimental design

Recommended replicates: at least 4

The core plots should be surrounded by 'guard' pots.



Figure 4.21 Basil grown in pots, on the greenhouse floor (left) or on benches (right).

Table 4.61

Typical number of basil plants for trials using two pot sizes.

	Pots Ø 9 cm	Pots Ø 12 cm
Minimum number of plants/ core plot	15	15
Minimum size core plot (m ²)	0.5	0.6
Pot density / m ²	30-35	25
Plants per pot	25-30	40-50

Table 4.63

Temperature requirements for germination and growth of basil.

Germination temperature °C Day/ Night	Days until germination	Optimal heating temperature for cultivation in °C Day/ Night
20 / 18°C Ventilation from 22°C	5 -8	18 / 16 °C Ventilation from 22 – 25°C

Crop nutrition

Table 4.64

Basil plant nutrient requirements.

Pot size	N (mg/pot)	P (mg/pot)	K (mg/pot)	Mg (mg/pot)
9 cm	320	50	200	50
12 cm	750	100	300	100

The nutrient requirement is dependent on the pot size and the number of plants per plot. If growing media with 20% compost is used additional phosphorus and potassium fertilisation is usually not needed. If necessary granulated organic fertiliser can be added. It should be noted that the nitrogen availability rate for organic fertilisers is estimated to be only about 60% ($N_{\text{available}}/N_{\text{total}}$). If the growing period is longer than five weeks it is best to apply a supplementary feed of organic fertiliser (either in liquid or solid form).

Crop management

Pruning of shoots is not common (with the exception of perennial types) but it will prolong the cultivation time. Basil is sensitive to excessive water application.

Disease and pest infestation, physiological disorders and other abiotic damage

This list includes links to relevant EPPO Guidelines:

Colletotrichum leaf spots - *Colletotrichum gloeosporioides* (PP 1/121(2) Leafspots of vegetables)

Downy mildew - *Peronospora behlbarii* (PP 1/65(3) - Downy mildews of lettuce and other vegetables)

Sciarid flies (fungus gnat, *Bradysia* sp.) are common in basil crop:

Natural enemies, like *Steinernema feltiae* or bio control agents (*Bacillus thuringiensis israelensis*) should be applied preventively (drench application). *Hypoaspis miles* may be useful in perennial basil.

The occurrence of other diseases and pests, like *Fusarium*, *Botrytis*, *Rhizoctonia* or pests like aphids or white flies should be recorded in the report.

Assessments during growth

- Leaf colour (1 = very light green, 3 = light green, 5 = medium green, 7 = dark green, 9 = very dark green).
- Anthocyanin - in red-leaved varieties (1 = absent or very weak, 3 = low, 5 = moderate, 7 = strongly, 9 = very strong).
- Leaf size - (1 = very small, 3 = small, 5 = moderate, 7 = large, 9 = very large).
- Leaf blistering (1 = absent or very weak, 3 = low, 5 = moderate, 7 = strongly, 9 = very strong).
- Uniformity of crop (1 = very poor, 3 = low, 5 = moderate, 7 = strongly, 9 = very uniform).
- Growth habit (1 = very erect, 3 = erect, 5 = moderate, 7 = compact, 9 = very compact).
- Number of plants per pot (the number of plants should be counted in 5 pots of each treatment).

Assessments at harvest

The crop is usually harvested with a plant height of 12 to 15 cm (although this may vary depending on local requirements). Shoots are cut 0.5 cm above the growing media, from at least 10 pots. Plant height, fresh weight and dry weight should be measured. The leaves are very sensitive to pressure.

If intended for processing into a herbal drug then extra assessments may be carried out. According to the European Pharmacopoeia:

- Leaves without stems will be dried at maximum of 30°C.
- Content of essential oil in ml /100 g (% v/m).
- Content of estragol (in % of essential oil).

Overall value score

This takes into account all criteria for the cultivation and marketing of a variety, based on expert opinion as evaluated by researchers using information from farmers, wholesalers and consumers (1 = very low, 3 = low, 5 = medium, 7 = high, 9 = very high).

References and further information

International Union for the Protection of New Varieties of Plants (UPOV). 2004.
Basil TG/200/1. www.upov.int