



BioGreenhouse

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

4.8 Ornamentals

Many different bedding and pot plant species are grown. Out of them Pelargonium is the most important bedding plant and it is described here as an example for other ornamental bedding plants that may be grown in pots.

4.8.1 Pelargoniums cultivated in pots

By Martin Koller and Robert Koch

Botanical name: *Pelargonium zonale* and *Pelargonium peltatum*

General crop requirements

Pelargoniums are sensitive to frost. Mostly they are propagated vegetatively and rooted cuttings are transplanted directly into the final pot. For organic growing a moderate temperature (between 12 – 16°C) is recommended in order to obtain strong plants with short internodes. The two important species (*P. peltatum* (ivy leaved) and *P. zonale*) have compact growth types that are better suited to organic cultivation than stronger-growing types.

The cultivation period depends on the temperature, light, the size of the pot and the stage at which plants are to be sold; it can vary from 10 to 16 weeks. A shorter cultivation period is needed for plants in smaller pots (less than 11cm diameter). The plants should be irrigated with caution in order not to stimulate the longitudinal growth.



Figure 4.27 Plants from a pelargonium pot trial to compare integrated with organic production.

Experimental design

Recommended replicates: at least four.

Table 4.75

Typical plant spacing for pelargoniums.

	Pot diameter 12 cm
Minimum number of plants / core plot	20
Pot density / m ²	24
Plants per pot	1

Table 4.76

Recommended heating temperature after transplanting the rooted transplant into the pot.

Growing stage	Day°C	Night°C	Ventilation from (°C)
Direct after transplanting	20	18	25
Cultivation after roots are established	14-16	12-14	18

Temperatures below 12°C should be avoided because nutrient mineralization in the growing medium will be too slow. A cultivation temperature of 16-18°C is usually recommended for conventional plants but will, in the absence of growth retardants, lead to elongated plants. A 'cool morning technique' (temperature drop of 8°C before or with the sunrise for 4 h) is recommended to control shoot growth.

Crop nutrition

The nutrient demand will vary depending on the growth habit and pot size. If growing media with a composition of 20% or more of compost is used, additional phosphorus or potassium fertiliser is usually not needed. It should be noted that the availability rate for nitrogen in organic fertilisers is estimated at 60 - 70% ($N_{\text{available}}/N_{\text{total}}$).

Table 4.77

Nutrient demand of a potted pelargonium plant.

Pot size	N	P	K	Mg
12 cm (mg / pot)	500 - 700 ⁽¹⁾	40 - 60	420 - 580	40 - 80

Crop management

Pinch out shoot tips to promote bushiness is recommended for strong-growing Zonale-Types (once or twice) and for most of the *Peltatum* types (twice), possibly from two weeks after transplanting until eight weeks before marketing.

Disease, pest problems and physiological disorders

Diseases:

- Bacterial blight - *Xanthomonas hortorum* pv. *pelargonii* (Syn. *X. campestris* pv. *pelargonii*).
- Rust - *Puccinia pelargonii-zonalis* (Only a problem on *P. zonale*).

Pests:

Aphids - many different species

Physiological disorder:

Oedema (Edema) is caused by high substrate moisture and low transpiration. *P. peltatum* are especially susceptible.

The occurrence of other diseases and pests (e.g. whiteflies) should be recorded in any report.

Assessments of growth and quality

For cultivar testing a detailed protocol for a wide range of characteristics is available from UPOV and CPVO. Assessments are usually made at the stage when the plants are marketed. These can include:

- Uniformity of crop (1 = absent or very weak, 3 = low, 5 = moderate, 7 = strongly, 9 = very strong).
- Growth habit (1 = very vigorous, 3 = vigorous, 5 = moderate, 7 = compact, 9 = very compact).
- Branching habit (1 = very poorly branched, 3 poorly branched, 5 = moderately branched, 7 = highly branched, 9 = very highly branched).
- Leaf colour (very light green, 3 = light green, 5 = medium green, 7=dark green, 9 = very dark green).
- Number of flowers. The numbers of flowers per plant is counted (or estimated) at least on 10 plants.
- Plant height. The height and the width of plant is measured at least on 10 plants at the stage at which the plants are normally marketed (and if appropriate also once or twice during the growing period). The width of the plant is measured at the maximum diameter of the plant and a second time in a 90 ° angle (because of the irregularity of growth). Afterwards the mean of these two measurements is calculated.
- Root development. For at least ten plants the pot is removed and the root development on the surface of the growing media is assed at the stage at which the plants are normally marketed - and if appropriate also once or twice during the growing period (1 = very poor root development, 3 = poor root development, 5 = moderate root development, 7 = densely rooted, 9 = very densely rooted).
- Shoot weight. After the growth assessment, the weight of the shoot is measured fresh and also after drying until the sample reaches a constant weight.

Overall value

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

References and further information

<http://www.cpvo.europa.eu>

International Union for the Protection of New Varieties of Plants (UPOV). 2004.

Zonale Pelargonium, Ivy Leaved- Pelargonium TG/28/9. <http://www.upov.int>