Cultivation of Tomato

Technical information sheet No. 8 1

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Greenhouse Management

Light

1% extra light, especially in the morning, produces 1% extra yield. A clean deck allows 30-40% more light to enter. Keep plastic cover as clean as possible and shade lightly in summer time.

Figure 1: Tunnel with open front (left) and sand screen giving less light (right).

Ventilation

First temperature should be controlled with ventilation of the greenhouse. Construction should be such that the ventilation openings can open to at least 30% of the floor surface. Opening of the front and rear of a traditional tunnel (45x9 m x 3.5m high) result in only 10%. Consequently the traditional tunnel gets too hot when outside temperatures rise above 30°C. A square opening in the centre of the tunnel gives only 2% additional ventilation opening, a slit will increase 15-22% (depending the width of the foil).

Figure 2:Tunnel with (too) small opening to ventilate (left); right a reasonable good ventilation slit

Cooling and Heating

If outside temperatures drop below 15°C heating should be considered. However it is not economic in open tunnels. Cooling is recommended in a tunnel when outside temperatures rise above 30°C frequently. Increasing humidity with a fogging system may give a higher humidity but also a lower temperature.

Cleaning

Before starting cultivation the ground in and around the tunnels should be free of weeds and plant remnants to decrease the disease pressure of fungi and insects.

Preparing Soilless System

Design

For optimal light interception per plant.

- V-system (2 row system):

☐ ←70 cm→ ☐ ← 90 cm → ☐ ←70 cm→ ☐ ← 90 cm → ☐

☐ ← 160 cm → ☐

Row distance is initially 160 cm, later in the season 90 cm. Spacing distance between plants within a row is 25 cm, when a plant density of 2.5 plants/m^2 is being used. Plants are alternating guided to the left and the right for even better and equal light interception and working space.

Figure 3: Troughs for a 2-row system (left), in combination with a transport/heating system in the path.

Troughs and irrigation

Troughs are for collecting drain water and for avoiding rooting in the subsoil, various profiles can be used. Important is leak free, easy handling in the greenhouse, to be cleaned and preferably cheap. Troughs should be laid down on a slope of 0.5% in the length. In the troughs bags filled with granulated substrate or slabs of coir or stone wool are laid down. A local substrate is only recommended if chemical and physical properties are known.

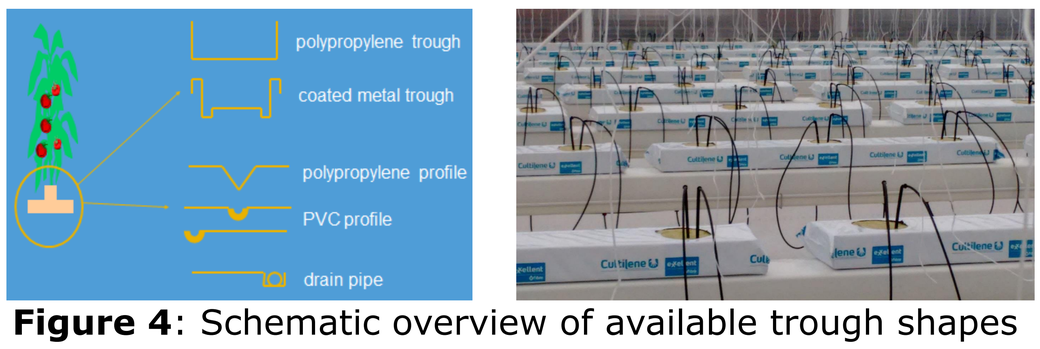

Figure 4: Schematic overview of available trough shapes (left); drip irrigation with spaghetti tubes is preferred above in-line drippers.

For irrigation mostly drip lines with pressure compensated drippers are used (uniform and not emptying on a slope). Capacity preferably 2 liter/hour. Those with capillaries or spaghetti tubes are preferred above in-line drippers, because of accuracy in placing around the plant.

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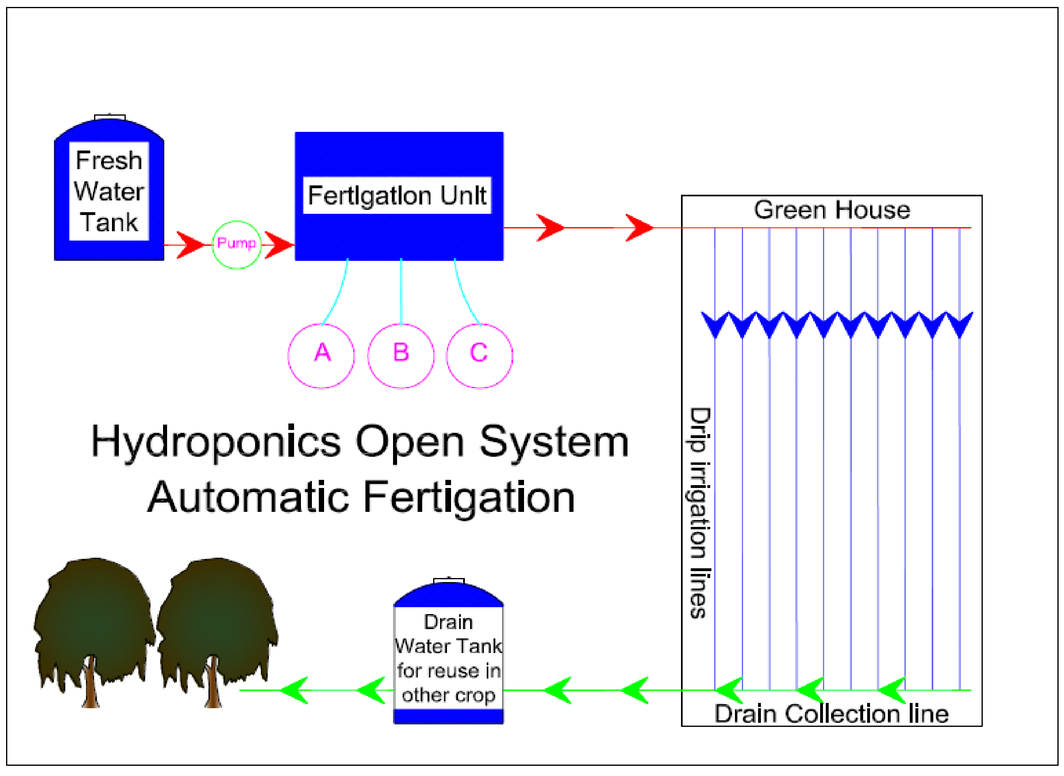

Figure 5: Schematic overview of fertigation system.

Substrate and irrigation

Fertigation

A fertigation unit mixes fresh water with stock solutions (100x concentrated) in A and B containers and if needed acid (tank C) and pumps it to the drip irrigation. Recommended EC is given in table below.

Table 1: Recommended EC levels (mS/cm) for tomato in various stages

	Tomato Rinsing slabs	First weeks	Full growth winter	Full growth summer
Irrigation water	3.8	3.5 – 4.5	3.2 – 3.8	2.5 - 2.8
Root environment	3.8	3.5 – 4.0	3.8 – 4.2	2.8 – 3.2
Drain water	3.8	3.5 – 4.5	4 - 45	3.0 – 3.5

Irrigation Frequency

The yield increases with increasing frequency, so give the smallest possible quantity with the highest possible frequency (at least more than 10x per day). You can limit the irrigation frequency by using the drain percentage.

Interval

Plants should be irrigated according to the radiation sum (2-3 ml/J/cm^2) they receive and when they are small also according to their light interception. Once plants have 3 times the floor area in leaves (LAI>3) they transpire at maximum speed.

Drain. The drain percentage should be 15-30%. When below 15% (EC around roots will increase) increase the irrigation frequency, when above decrease.

Covering the substrate

The substrate is packed in and covered on top with black/white plastic. Black/white is light impermeable to prevent:

- algae and weed growing on the substrate.
- high temperatures in the substrate.
- evaporation from the substrate.

Figure 6: Tomato in preferred white bags and a full grown crop

Moisture holding capacity. The water binding force of the plug or block must not exceed that of the cultivation medium (bag or slab). Otherwise the plug will stay too wet and the young plant will grow slower and get diseased.

Nutrient level (EC). EC in the transplant medium must be higher than the EC of the cultivation medium. If not roots of young plants will not grow into the cultivation medium.

Chemical properties substrate. Before buying any substrate the following contents should be known: total salt load EC< 0.5 dS/m; pH = 4.5-6.5; sodium chloride < 1 mmol/L; sulphate <2 mmol/L; bicarbonate <2 mmol/); B <10 micromole/L; Mn <10 mmol/L. When saturated the medium should still contain >15% of air filled pores.

Table 2: Nutrient recipe for cucumber

Element	Standard nutrient solution Closed system	Open system	Target value in root environment
EC, mS/cm	1.6	2.1	2.7
pH			6.2
NH_4, mmol/l	0.5	0.5	0.1
K	5.75	6.75	5
Na			<8
Ca	3.5	6.0	8.5
Mg	1.125	1.5	3
NO3	12.5	15.5	17
Cl			
SO4	1.0	1.75	3
HCO3			<1
H2PO4	1.0	1.25	1.2
Fe, µmol/l	15	15	15
Mn	10	10	5
Zn	4	5	7
B	25	30	80
Cu	0.75	0.75	0.7
Mo	0.5	0.5	0.5

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