

# Blueberries

Irrigation and fertigation protocol  
soil & soilless



# Irrigation and fertigation protocol for blueberries grown **in soil**



## INTRODUCTION

Blueberries are a challenging crop due to their sensitivity to water stress, salinity and acidity levels. Based on our extensive agronomic experience, we provide irrigation and fertigation guidelines that will help you increase yields while optimizing use of water and fertilizers. These guidelines are intended for Northern, Southern and Rabbiteye varieties, grown in local soil with a target yield of 4Kg/plant. We recommend adjusting your plan based on your specific local conditions related to soil type, climate, variety, planting patterns and yield targets.



## IRRIGATION - GUIDELINES

- Recommendations are for drip irrigation. If using micro-sprinklers add 20% to the water dose.
- Recommendations are based on zero rainfall.
- Effective rain event is one over 10mm.
- Rain efficiency should be calculated at 60% rate.
- After a significant rain event, you should resume irrigation when top soil layer starts drying. If soil is sandy or when climate is hot it can be within 2-3 days. If soil is heavy or in cooler periods it can be up to 7-8 days.
- Recommendations are for fully grown plants. If plants are already productive but canopy is not fully grown, use the correction factor (Fc) to adjust the irrigation amount.
- Blueberries have a very shallow root zone with no root hairs so frequent irrigation is important.
- Blueberries are sensitive to both water deficit and water excess.
- Blueberries are sensitive to salinity. Do not irrigate with water that has EC levels above 2ds/m.



## FERTIGATION GUIDELINES

- We recommend applying fertilizer in every irrigation, so split the total amount for the relevant period in to expected irrigation events.
- Fertigation should start only after the system is fully pressurized and stopped 30 min before irrigation is stopped.
- If you can not fertigate every irrigation, it is recommended to fertigate at least once a week.
- In case of rain, skip irrigation but do not skip fertigation. Fertigate with a high concentration of fertilizer and a small water volume.
- Blueberries requires acidic surroundings. pH should be adapted to 4.5-5.2 (5-5.5 for Rabbiteye)
- Blueberries prefer NH<sub>4</sub> over NO<sub>3</sub>, thus use appropriate fertilizers (high Ammonium) and take into consideration the effect of the fertilizers on soil pH
- % NH<sub>4</sub>/N-TOTAL: ~70%

## IRRIGATION

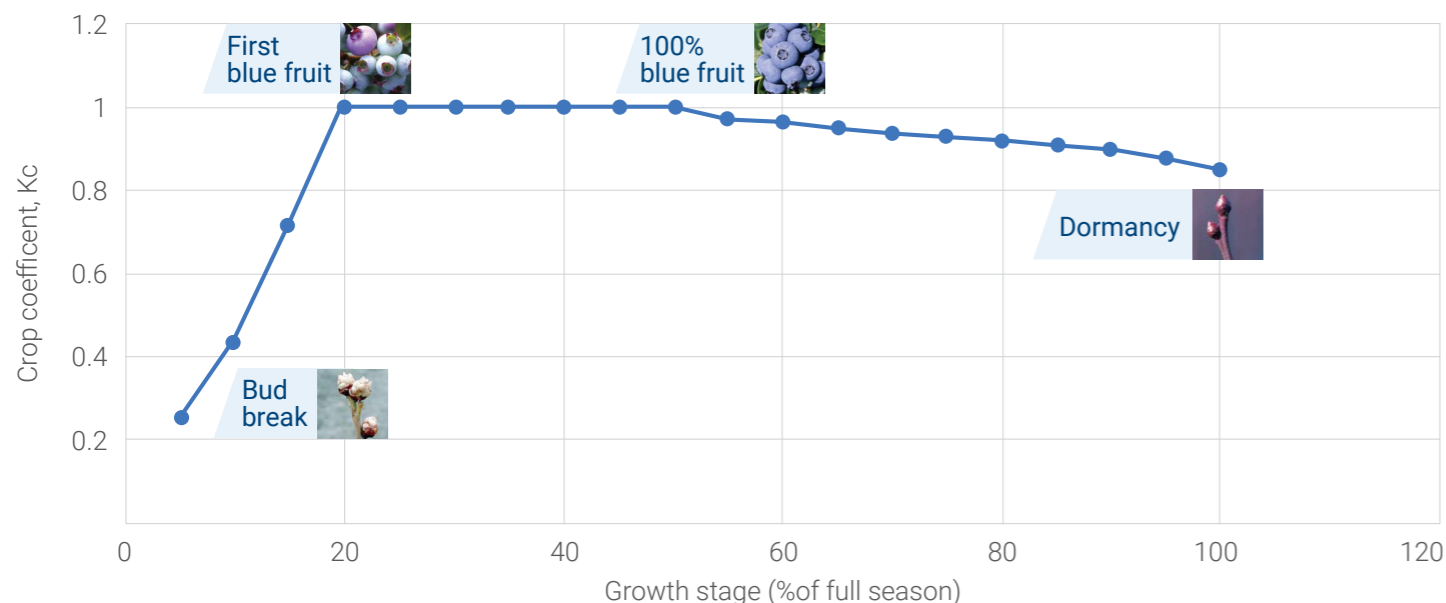
### F<sub>c</sub> – Adjusting factor for young plants with partial canopy coverage

$$\text{Blueberry ET} = \text{ET}_o \times K_c \times F_c \rightarrow F_c = 0.25 + 0.0118 S_h \rightarrow S_h = \frac{A_s}{H \times L}$$

Potential ET
Crop coefficient
Correction factor
Percent shade
Shade area (m<sup>2</sup>)
Plant spacing (m<sup>2</sup>)

From Holzapfel et al. (2003)

### K<sub>c</sub> – BLUEBERRY CROP COEFFICIENT CURVE









## BLUEBERRY N FERTILIZER RATE

YEAR	N (KG/HA)
1	100
2	100
3	65
4	80
5	110
6	140
7	165
8	185



A higher amount of N fertilizer is recommended during years 1-2 since NH<sub>4</sub> mobility in the soil is limited and the root system is still undeveloped. By applying some surplus you can avoid deficiencies.

**FERTIGATION CALENDER - GENERAL RECOMMENDATIONS BY CROP STAGE**

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	
	Bud break	Flowering	Fruit set	Fruit coloring	Harvest	Post harvest	Total
							
N (Kg/ha)	10	10	55	80		30	185
P <sub>2</sub> O <sub>5</sub> (Kg/ha)	4	4	30	35		20	93
K <sub>2</sub> O (Kg/ha)	10	10	50	65		34	169
CaO (Kg/ha)	10	10	80	100		0	200
MgO (Kg/ha)	5	10	35	50		25	125
	20 days		40 days		150 days		35 days

These are general guidelines only. We highly recommend adjusting your fertigation according to your specific soil and leaf nutrients content by using the bellow tables:

**CRITICAL LEVELS FOR SOIL NUTRIENT CONTENT**

NUTRIENT	Phosphorus (P: Bray)	Phosphorus (Olsen)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Manganese (Mn)	Boron (B)
UNIT	ppm	ppm	ppm	ppm	ppm	ppm	ppm
DEFICIENT AT LESS THAN:	25 to 50	10	100 to 150	1000	60	20	0.5

Basing N fertilization on soil N levels is not recommended

**LEAF NUTRIENT SUFFICIENCY LEVELS (LATE SUMMER SAMPLING)**

NUTRIENT	NORTHERN Highbush	SOUTHERN Highbush	RABBIT-EYE
Nitrogen (%N)	1.76-2	1.8-2.1	1.2-1.7
Phosphorus (%P)	0.11-0.4	0.12-0.4	0.08-0.17
Potassium (%K)	0.41-0.7	0.35-0.65	0.28-0.6
Calcium (%Ca)	0.41-0.8	0.4-0.8	0.24-0.7
Magnesium (%Mg)	0.13-0.25	0.12-0.25	0.14-0.2
Sulfur (%S)	0.11-0.16	0.12-0.25	Na
Manganese (ppm Mn)	31-350	50-350	25-100
Boron (ppm B)	30-80	30-7	12-35
Iron (ppm Fe)	60-200	60-200	25-70
Zinc (ppm Zn)	8-30	8-30	10-25
Copper (ppm Cu)	5-15	5-20	2-10

# Irrigation and fertigation protocol for blueberries grown in soilless substrate

## INTRODUCTION

Blueberries are a challenging crop due to their sensitivity to water stress, salinity and acidity levels. Based on our extensive agronomic experience, we provide irrigation and fertigation guidelines that will help you increase yields while optimizing use of water and fertilizers. These guidelines are intended for Northern, Southern and Rabbiteye varieties, grown in soilless substrates with a target yield of 4Kg/plant.

We recommend adjusting your plan based on your specific local conditions related to substrate type and water holding capacity, climate, variety, planting patterns and yield targets.



## IRRIGATION - GUIDELINES

- Substrates volume, chemical and physical characteristics and container dimensions and shape have a major effect on irrigation quantity and frequency. This must be taken in to consideration during irrigation planning.
- As container volume is limited, frequent irrigation may be needed and beneficial. Yet, length of irrigations must be moderate (>5 min) to avoid salination of the substrate.
- Adequate drainage is crucial to avoid salination of the substrate.
- On-going chemical analysis of both drainage water and irrigation water are crucial.
- Always keep EC-out level higher by ~0.5 point than EC-in level.
- Blueberries have a very shallow root zone with no root hairs so frequent irrigation is important.
- Blueberries are sensitive to both water deficit and water excess.
- Blueberries are sensitive to salinity. Do not irrigate with water that has EC levels above 2ds/m.



## FERTIGATION - GUIDELINES

- In soilless substrate we work in concentrations, not quantities.
- It is recommended to apply fertilizer in every irrigation, so split the total amount for the relevant period in to expected irrigation events.
- Determine the required nutrient for plant growth according to plant development status.
- Adjust the nutrition procedure according to substrate characteristics.
- Determine the correct ratio between the various elements.
- Adjust the pH level.
- Avoid salinity problems.
- Trace elements are absent in soilless media and, therefore, must be added.
- Continuance, on-going chemical analysis of both drainage water and irrigation water are crucial.
- Blueberries require acidic surroundings. pH should be adapted to 4.5-5.2 (5-5.5 for Rabbiteye)
- Blueberries prefer NH<sub>4</sub> over NO<sub>3</sub>. Use appropriate fertilizers (high Ammonium, mainly during vegetative stage) and take in to consideration the effect of the fertilizers on soil pH.
- Maintain a high level of micro-elements, mainly during vegetative stage.
- When moving from vegetative stage to flower bud differentiation, Total N amount and NH<sub>4</sub> percentage should be decreased. K, Mg and Ca should be increased.
- One day of irrigation without fertilizers is recommended once every week or two, since substrate EC typically increases due to frequent use of Sulphur-rich fertilizers.

VEGETATIVE													
Element	N-NO3	N-NH4	N-TOTAL	P2O5	K2O	Ca	Mg	Fe	Mn	Zn	Cu	Mo	B
ppm	35	85	120	120	60	60	30	2.5	1	1	0.1-0.2	0.1	0.3
Element	NO3	NH4	N-TOTAL	H <sub>2</sub> PO <sub>4</sub>	K	Ca	Mg						
mmol/l	2.5	6.1	8.6	1.7	1.3	1.5	1.25						
DIFFERENTIATION													
Element	N-NO3	N-NH4	N-TOTAL	P2O5	K2O	Ca	Mg	Fe	Mn	Zn	Cu	Mo	B
ppm	50	30	80	120	240	80	40	2.5	1	0.7-1	0.1-0.2	0.1	0.3
Element	NO3	NH4	N-TOTAL	H <sub>2</sub> PO <sub>4</sub>	K	Ca	Mg						
mmol/l	3.6	2.1	5.7	1.7	5.1	2.0	1.67						
FLOWERING & HARVEST													
Element	N-NO3	N-NH4	N-TOTAL	P2O5	K2O	Ca	Mg	Fe	Mn	Zn	Cu	Mo	B
ppm	50	50	100	120	130	70	35	2.5	1	0.7-1	0.1-0.2	0.1	0.3-0.5
Element	NO3	NH4	N-TOTAL	H <sub>2</sub> PO <sub>4</sub>	K	Ca	Mg						
mmol/l	3.6	3.6	7.1	1.7	2.8	1.8	1.46						

SUMMARY	N-NO3	N-NH4	N-TOTAL	P2O5	K2O	Ca	Mg	Ec (in)	% N-NH4/N-TOTAL	K2O/N	Ph	S
VEGETATIVE	35	85	120	120	80	60	30	1.2-1.4	70%	0.7	4.8-5.2	Varies according to acidification needs and fertilizer used
DIFFERENTIATION	50	30	80	120	240	80	40	1.4-1.6	40%	3.0	4.8-5.2	
HARVESTING	50-60	50-60	100-120	120	130-160	70	35	1.2-1.4	50%	1.3-1.6	4.8-5.2	



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