



FERTILISATION PROGRAMS with SICOGREEN water soluble NPK's Examples

<u>I. PEPPERS</u>

<u>1) Peppers in tunnels</u> Target yield: 50 MT/ha

Stage Days		Sicogreen formula	kg/ha/day	Total kg/ha	
Initial establishment	7	15-30-15	8	56	
Vegetative to fruit-set	20	19-19-19	13	260	
Fruit-set to 1st harvest	20	18-9-27	13	260	
1st harvest to last harvest	10	18-9-27	13	130	

To cure and prevent magnesium deficiency, apply Magnesium Nitrate by fertirrigation or by foliar spray or order SICOGREEN water soluble NPK formulations with MgO already included.

2) Greenhouse peppers Target yield: 120 MT/ha

Stage	Days	Sicogreen formula	kg/ha/day	Total kg/ha	
Initial establishment	10	15-30-15	8	80	
Vegetative to fruit-set	25	19-19-19	13	325	
Fruit-set to 1st harvest	20	18-9-27	15	600	
1st harvest to last harvest	100	18-9-27	13	1300	

To cure and prevent magnesium deficiency, apply Magnesium Nitrate by fertirrigation or by foliar spray or order SICOGREEN water soluble NPK formulations with MgO already included.

II. TOMATOES

1) Tomatoes in tunnels

Target yield: 150 MT/ha

Stage	Days	Sicogreen formula	kg/ha/day	Total kg/ha	
Planting to flowering	25	20-20-20	8	200	
Flowering to fruit-set	20	14-7-21 + 2 MgO	15	600	
Fruit-set to 1st harvest	35	14-7-28 + 2 MgO	17	595	
1st harvest to last harvest	100	14-7-28 + 2 MgO	18	1800	

To cure and prevent magnesium deficiency, apply Magnesium Nitrate by fertirrigation or by foliar spray or order SICOGREEN water soluble NPK formulations with MgO already included.

2) Greenhouse tomatoes

Target yield: 120 MT/ha

Stage	Days	Sicogreen formula	kg/ha/day	Total kg/ha	
Initial establishment	8	15-30-15	8	64	
Vegetative to fruit-set	25	19-19-19	13	325	
Fruit-set to 1st harvest	30	18-9-27	17	510	
1st harvest to last harvest	110	16-8-32	17	1870	

To cure and prevent magnesium deficiency, apply Magnesium Nitrate by fertirrigation or by foliar spray or order SICOGREEN water soluble NPK formulations with MgO already included.

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III. MELONS

<u>1) Melons in 1 - 2 m tunnels</u> Target yield: 35 MT/ha

Stage	Days	Sicogreen formula	kg/ha/day	Total kg/ha	
Planting to flowering	25	20-20-20	8	200	
Flowering to fruit-set	20	14-7-21 + 2 MgO	15	300	
Fruit-set to harvest	50	14-7-28 + 2 MgO	22	1100	

To cure and prevent magnesium deficiency, apply Magnesium Nitrate by fertirrigation or by foliar spray or order SICOGREEN water soluble NPK formulations with MgO already included.

2) Greenhouse melons

Target yield: 50 MT/ha

Stage	Days	Sicogreen formula	kg/ha/day	Total kg/ha	
Initial establishment	10	15-30-15	8	80	
Vegetative to fruit-set	20	19-19-19	13	260	
Fruit-set to 1st harvest	40	18-9-27	15	600	
1st harvest to last harvest	60	16-8-32	13	780	

To cure and prevent magnesium deficiency, apply Magnesium Nitrate by fertirrigation or by foliar spray or order SICOGREEN water soluble NPK formulations with MgO already included.

IV. POTATOES

Target yield: 60 MT/ha

Stage	Days	Sicogreen formula	kg/ha/day	Total kg/ha	
Planting & development	30	20-20-20	6	180	
Tuber initiation	25	14-7-21 + 2 MgO	18	450	
Tuber growth	55	14-7-21 + 2 MgO	18	990	

Foliar feeding:

Growth stage Sicogreen formula		Concentration	Spray volume
Vegetative stage	Sicogreen Booster 21.21.21 + TE	2 - 5%	50 - 80 l/ha
Tuber growth	Sicogreen Potato 12.5.40 + TE	2 - 4%	50 - 80 l/ha

To cure and prevent magnesium deficiency, apply Magnesium Nitrate by fertirrigation or by foliar spray or order SICOGREEN water soluble NPK formulations with MgO already included.

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SICOGREEN[®] FERTILISATION RECOMMENDATIONS Examples

1. FERTIGATION IN ORCHARDS

Crop	Expected yield (MT/ha)	Bloom to flowering	Flowering to fruit set	Fruit set to harvest (*)	Reserves for Autumn		Total kg/ha)	
		20-20-20 kg/ha	14-7-21 kg/ha	14-7-28 kg/ha	14-7-28 kg/ha	N	P2O5	К2О
Apples		160	200	260	60	111	71	164
Pears	25	100	110	160	50	66	43	96
Peach	35	120	120	340	60	100	62	133
Kiwi	30	100	200	500	60	116	69	202

Сгор	Expected yield (MT/ha)	Spring flush	Flowering	Fruit growth (*)	Reserves for Autumn		Total (kg/ha)	
		20-20-20 kg/ha	23-7-23 kg/ha	14-7-28 kg/ha	23-7-23 kg/ha	N	P2O5	К2О
Orange Grapefruit	50 60	150 200	350 400	250 300	200 200	192 220	66 103	227 262

Cease fertigation 30 days before harvest.

Сгор	Expected yield (MT/ha)	Flowering (a)	Fruit set	Fruit growth (b)	After harvest		Total (kg/ha)	
Mango	20	100	160	450	60	127	70	202

a) Enhance flowering induction by foliar application of SICOGREEN (12-5-43) 3 weeks before flowering.

b) Cease fertigation 45 days before harvest.

Сгор	Expected yield (MT/ha)	Blooming	Flowering	Fruit growth	After harvest		Total (kg/ha)	
Grapes	60	200	100	200	300	151	82	186

Cease fertigation 45 days before harvest.

* Foliar appliation of high potassium SICOGREEN formulae is recommended at this stage. Magnesium deficiency can be corrected by foliar application of Magnesium Nitrate.

2. FERTIGATION OF FRUITS & VEGETABLES IN OPEN FIELDS & TUNNELS

Сгор	Expected yield (MT/ha)	Planting to flowering	Flowering to fruit set	Fruit set to harvest	1st harvest to last harvest)	Total (kg/ha)	
		20-20-20 kg/ha	14-7-21 kg/ha	14-7-28 kg/ha	14-7-28 kg/ha	Ν	P2O5	K2O
Tomatoes	150 80	330 330	550 550	1000 1600	2000	563 367	315 217	1022 630
Melons	40 25	130 110	540 540	440 500	360 -	214 168	120 95	363 275
Peppers	80 50	200 00	250 300	1200 (**) 800 (**)	1000 (*) -	383 194	212 117	555 271

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Сгор	Expected yield (MT/ha)	Early season	Mid season	Late season		Total (kg/ha)
Onions	50	120	4000	700	 178	101	304
Potatoes	60	150	300	1000	212	121	373
Lettuce	35	150	250(*)	-	80	53	60
Watermelon	50	120	300	350	115	70	185

* Use SICOGREEN 20-9-20

** 2-1-3 ratio is required at this stage also: use SICOGREEN 14-7-21

3. FERTIGATION IN SOILLESS MEDIA

Crop		ntration ir e main pro				Formula	Conc. kg/m3	
	Ν	P2O5	K2O	CaO	MgO		k(***)	
Tomatoes *	170	100	410	220	80	11-8-34	1.1	+ SICALNIT calcium nitrate
**	170	100	270	150	70	17-10-27	1.0	+ acid
Cucumbers *	200	80	320	220	50	16-8-32	0.9	+ SICALNIT calcium nitrate + acid
**	220	100	280	200	60	16-8-32	0.9	+ acid
Pepper *	180	100	280	200	60	16-8-32	0.8	+ SICALNIT calcium nitrate + acid
**	170	100	230	140	70	17-10-27	0.9	+ acid
Strawberry	50	60	160	90	25	9-12-36	0.5	
Melons	200	100	340	200	70	16-8-32	1.0	
Roses	140	95	380	160	50	14-10-34	1.0	
Gerbera	180	110	310	160	50	17-10-27	1.0	

* Moderate or cold climate, low radiation (North France, U.K., Belgium, The Netherlands, Poland, Russia, Japan, Korea, etc.); water is generally "soft".

** Hot climate, high radiation (South France, Italy, Spain, Canary Island, Greece, Morocco, etc.); water is generally "hard".

*** At earlier phases, use concentrations of 0.3 - 0.7 kg/m3.

Determining the fertigation program, take into account calcium and magnesium concentrations in the water. Add SICO PENETRATOR or acid to correct pH, and complements such as magnesium nitrate or magnesium sulphate, if necessary.

Conversion table:

1 kg P = 2.29 kg	P2O5
1 kg K = 1.2 kg	K2O
1 kg Ca = 1.4 kg	CaO
1 kg Mg = 1.66 kg	MgO
1 kg S = 2.5 kg	SO3

4. FOLIAR SPRAY ON FRUITS & VEGETABLES

	Concentration	Volume
Vegetables	0.5 - 1%	150 - 400 l/ha
Orchards	1 - 4%	1000 - 4000 l/ha

For ultra low volumes, higher concentrations can be used.

The recommendations brought here should be regarded as a general guide only. The exact fertilisation program should be determined according to the specific crop needs, soil and water conditions, and the grower's experience.

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SICOGREEN[®] FERTILISATION RECOMMENDATIONS Examples for Maize (Corn) & Cucumber

<u>RECOMMENDATIONS FOR FOLIAR FEEDING OF MAIZE</u>

1. For human consumption and for oil extraction

Growth Stage	Recommended	Rate*	:	
	Products	Surface application	Aerial application	
Plants are approx. 50 cm high	Multi-K**, Multi-NPK, Multu-KMg	1 - 2% 3 - 4 kg/ha	10% 5 - 6 kg/ha	
50% of the plants are at tasseling stage (male flowers are fully seen)	Same	2% 5 kg/ha	Same	

* Spray volume should be determined according to local vegetative conditions.

** Multi-K = Potassium Nitrate (KNO₃) 13-0-46

Macro-elements removed	by 1	l ton	of kernels	(kg/ton)

Ν	15	P	3
К	4	Ca	0.5
Mg	1	S	1 - 3

2. For seed production

Growth Stage	Recommended	Rate*	۲	
	Products	Surface application	Aerial application	
Plants are approx. 50 cm high	Multi-K**, Multi-NPK, Multu-KMg	1 - 2% 3 - 4 kg/ha	10% 5 - 6 kg/ha	
While female flowering	Same	2% 5 kg/ha	Same	

* Spray volume should be determined according to local vegetative conditions.

** Multi-K = Potassium Nitrate (KNO₃) 13-0-46

RECOMMENDATIONS FOR FERTILISATION OF CORN (WHOLE PLANT)

Macro-elements	s remove	d by 1 ton marketab	<u>ple product (kg/ton)</u>
N	27	Р	4.5
К	20	Ca	5
Mg	4.5	S	2 – 6

RECOMMENDATIONS FOR FERTILISATION OF CORN (GRAIN)

Macro-elements removed by 1 ton marketable product (kg/ha)

Ν	120	Р ₂ О ₅	300
к ₂ 0	120	Borate	40
Zn S	ulphate 45		

PLANT ANALYSIS GUIDE / NUTRIENT SUFFICIENCY RANGES

(source A & L. Agronomy Handbook, Ankerman & Large Eds.)

Corn (a tasseling		S %	P %	K %	Mg %	Ca %	Na %	B ppm	Zn ppm	Mn ppm	Fe ppm	Cu ppm	Al ppm	Mo ppm
From	2.80	0.20	0.25	1.80	0.20	0.30	0.01	6	25	30	50	6	20	
То	3.50	0.50	0.40	3.00	0.50	0.70	0.03	20	50	100	250	20	300	

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Plant part to sample:

- * 8-leaf stage: Whole above ground portion of plant.
- * Just prior to tasseling: Leaf below and opposite from ear.
- * Immediately after silking: Leaf below and opposite from ear.

Sweet corn

- Plant part to sample:
- * Time of sampling: Tasseling.
- * Plant part: Midrib of first leaf above primary ear.

Plant tissue sampling procedures:

<u>Stage of growth</u>	<u>Plant part</u>
* Seedling stage	All of above ground portio
* Prior to tasseling	First fully developed leaf below whorl

RECOMMENDATIONS FOR FERTILISATION OF CUCUMBERS

1. Open field

Plant density of 30,000 - 40,000/ha Expected yield of 25 - 35 ton/ha

a) Pre-plant application

Nutrient demand (kg/ha)			Recommende	ha)			
N	P205	к ₂ 0	CaO	so ₃	Ammonium	Single Super	Potassium
	_			_	Sulfate*	Phosphate**	Sulfate
150	160	300	65	225	750	800	600

* Other nitrogen sources can also be used, with the necessary revisions, but AS also supplies the S.

** Other phosphorus sources can also be used, with the necessary revisions, but SSP also supplies the Ca.

b) Side dressing

Month after sowing	Growth stage	Nutrio N		nd (kg/ha/month) K ₂ O	Recommen Multi-K*	ided fertilisers (kg) Multi MAP**	/ha/month) AN***
1st	vegetative development	30	30	20	45	50	55
2nd	flowering fruit-set	60	30	90	195	50	85
3rd to end	fruit develop. & harvest	60	30	90	195	50	85
	Total	150	90	200	435	150	225

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* Multi-K = Potassium Nitrate (KNO₃) 13-0-46

** Multi MAP = Mono-Ammonium Phosphate 12-61-0

*** AN = Ammonium Nitrate 35.5-0-0

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c) Fertigation(*)

Month after sowing	Growth stage	Nutrie N		nd (kg/ha/day) K ₂ O	Recommende Multi-K*	d fertilisers (kg/ Multi MAP**	ha/day) AN***
1st development	vegetative	1.0	1.0	0.7	1.4	1.6	1.8
2nd	flowering fruit-set	2.0	1.0	1.0	6.5	1.6	3.0
3rd to end	fruit develop. & harvest	2.0	1.0	1.0	6.5	1.6	3.0
	Total	150	90	200	435	150	225

(*) The fertilisers should be applied every 1 - 2 irrigation cycles.

* Multi-K = Potassium Nitrate (KNO₃) 13-0-46

** Multi MAP = Mono-Ammonium Phosphate 12-61-0 *** AN = Ammonium Nitrate 35.5 -0-0

2) Greenhouse or tunnel, growth in soil

Plant density of 18,000 - 24,000/ha Expected yield of 120 - 150 ton/ha

Total nutrient requirements (kg/ha)

N	200 - 240
P_2O_5	130 - 150
K ₂ O	300 - 350

a) Pre-plant application

Nutrient demand (kg/ha)			Recommende	Recommended fertilisers (kg/ha)			
N	P205	К ₂ О	Ammonium	Single Super	SOP		
			Sulphate*	Phosphate**			
21	80 - 100	80 - 100	100	175 - 220	160 - 200		

* Other nitrogen sources, such as AN or urea can also be used, with the necessary revisions.

** Other phosphorus sources, such as DAP or SSP can also be used, with the necessary revisions.

b) Fertigation or side dressing

Growth stage	Nutrie N	ent dema P2 ⁰ 5	nd (kg/ha/day) K ₂ O	Recomr Multi-K	nended fertilisers (kg/ * Multi MAP**	ha/day) AN***	
Establishment	1.0	1.0	1.0	2.2	1.6	1.5	
vegetative flowering	2.0	1.0	2.0	4.5	1.6	2.2	
flowering fruit-set	2.5	1.0	3.5	8.0	1.6	4.0	
fruitset & harvest	3.5	-	4.5	10	1.6	6.5	

* Multi-K = Potassium Nitrate (KNO₃) 13-0-46

** Multi MAP = Mono-Ammonium Phosphate 12-61-0

*** AN = Ammonium Nitrate 35.5 -0-0

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d) Secondary nutrients

* Magnesium:	Magnesium should be applied throughout the growing season, and adjusted according to the concentration in the soil and irrigation water. Total required rate = 0.4 - 0.6 kg/ha/day (MgO) preferably as magnesium nitrate. Proportional rate = 30 - 40 (MgO) g/m ³ preferably as magnesium nitrate.
* Calcium:	Calcium should be applied from fruit set until the end of harvest. Dosage should be adjusted according to the concentration in the soil and irrigation water. Total required rate = $2 - 4 \text{ kg/ha/day}$ (CaO). Proportional rate = $80 - 120$ (CaO) g/m ³ .

e) When proportional fertigation setup is available

Nutrients should be applied at the following rates during the indicated physiological stages:

Physiological stage	2	N	P205	к ₂ 0	CaO	MgO
	Ratio	1	0.7	1.3	1.3	0.8
Establishment	Rate (mg/ltr. = ppm)	60 - 80	44 - 55	70 - 110	84 - 100	50 - 66
Flowering &	Ratio	1	0.4	1.5	0.65	0.3
production	Rate (mg/ltr. = ppm)	180 – 22	75 - 95	280 - 320	110 - 140	50 - 66

Micronutrients should be maintained at the following levels (ppm) in the nutrition solution throughout the growth period:

Fe	1 - 1.5	Mn	0.5 - 0.8
Zn	0.1 - 0.3	Cu	0.05 - 0.1
В	0.3	Мо	0.05

For the fertigated solution, EC should not exceed 2.2 dS/m and pH should be maintained at 5.5 - 6.5

3) Greenhouse or tunnel, growth in soilless culture

a) Special consideration for practicing of fertigation in soilless grown cucumbers

Cucumbers can be grown in greenhouses in a number of soilless media such as perlite, rockwool, peat, etc... When growing cucumbers in soilless media special care must be taken in monitoring the nutrients that the crop receives. The following factors should be taken into account: (Avidan, 1998)

- * **pH**: The pH in the nutrient solution should be maintained at a level of 6 6.5. The pH can be lowered by the use of acids. Adjustment of pH levels can be accomplished by slight changes in the nitrate /ammonium ration in the nutrient solution.
- * **Electrical Conductivity (EC)**: The difference between the EC of the nutrient solution and the drain water should not exceed 0.4 0.5 dS/m (depending on the proprties of the water supply).
- * **Nitrate (NO₃)**: The level of nitrate in the drain water should be 500 600 ppm depending on the nitrate level, which changes according to the growing season.
- * Nitrate / Ammonium ratio: Should not be lower than 5:1.
- * Nitrite (NO₂): The level of nitrite should be zero, because its presence in the growth medium impairs
 - roots functioning and causes browning.

In addition, it should be borne in mind that a high level of either ammonia or ammonium interferes with the ability of the roots to absorb K (Schenk and Wehrmann, 1979).







	Nutri	Nutrient requirements (g/m ³ = ppm)					Recommended fertilisers (g/m ³ = ppm)			
Growth stage	N	P2 ⁰ 5	к ₂ 0	CaO	MgO	Multi-K*	MAP	AN	CN	Mg** Sulfate
Establishment flowering	180	90	180	100	40	400	150	160	380	120
Flowering Fruit set production	240	90	370	200	80	800	150	-	760	240

* Multi-K = Potassium Nitrate (KNO₃) 13-0-46

** This source of magnesium was selected to provide the sulfate to the medium.

	Nutrient solution	Root environment
Parameter	< 2.2	< 3
pН	5.5 -	6.5

Micronutrients should be maintained the following levels (ppm) throughout the growth period:

Fe	0.9	Mn	0.55
Zn	0.32	Cu	0.05
В	0.25	Мо	0.05

4) Foliar sprays

a) Nutritive foliar application

Multi-K at concentration of 1.5 - 2% in water were found to be the most effective nutritive solution for boosting vegetative and production response of the plants. However, the safe concentration should be determined by spraying the solution onto a small area a few days prior to the actual treatment to assess whether there may be any adverse effects.

b) Disease control

Multi-K at a concentration of 1.5% as well as Multi-Keep (Mono Potassium Phosphate) at a concentration of 1 - 2%, sprayed at 500 ltrs./ha.

c) Control of powdery mildew

- * Multi-K at a concentration of 1.5%.
- * Multi-Keep (Mono Potassium Phosphate) at a concentration of 1 2%, sprayed at 500 ltrs./ha, successfully
- controls powdery mildew and has a marked positive effect on other major fungal diseases such as downy mildew.

* A combined program of potassium salt plus timely application of conventional fungicides may slow the

development of fungicide-resistant races of the pathogens in the field.

5) Nutrition database for cucumber

	Concentration						
	Rockwool		Rockwool (reuse drainage)		Plant - dry matter (7 - 8%)		
Parameter	Nutrient solution	Root environm.	Nutrient solution	Root environm.	Guiding Range	Deficient	Excess
EC (mS/cm)	2.2	3.0	1.7	3.0			
	(mg/l)		(mg/l)		(%)		
NH ₄	22.5	< 9.0	18.0	< 9.0			
N-NH ₄	17.3	< 6.9	13.8	< 6.9			
K in sap					0.59 - 0.63	< 0.18	
К	312.8	312.8	254.2	312.8	3.13 - 3.91	< 2.35	
Ca	160.4	260.7	110.3	260.7	2.41 - 3.21	< 1.20	

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	Concentration						
	Rockw	ool	Rockwool (reuse drainage)		Plant - dry matter (7 - 8%)		
Parameter	Nutrient solution	Root environm.	Nutrient solution	Root environm.	Guiding Range	Deficient	Exces
	(mg/l)		(mg/l)		(%)		
Mg	33.4	72.9	24.3	72.9	0.36 - 0.73	< 0.37	
N, total					4.20 - 5.60		
NO3	992.0	1116.0	728.5	1116.0	1.86		
N-NO3	223.9	251.9	164.4	251.9	0.42		
S, total					0.32		
so ₄	132.1	336.4	96.1	336.4			
Р					0.62 - 0.93	< 0.47	
н ₂ ро ₄	121.3	87.3	121.3	87.3			
Si	21.1	16.9	21.1	16.9			
Na					0.06 - 0.07		
					mg/kg (ppm)		
Fe	0.838	0.838	0.838	1.396	83.8 - 111.7		
Mn	0.549	0.385	0.549	0.385	54.9 - 164.8		> 549.0*
Zn	0.327	0.458	0.327	0.458	49.0 - 143.8	< 26.1	
В	0.270	0.540	0.270	2.540	54.0 - 75.6	< 43.2	< 108.1
Cu	0.048	0.095	0.048	0.095	10.2	< 8.9**	
Мо	0.048	-	0.048	-	0.96 - 9.59	< 0.29	

* in old leaves

** in young leaves; in old leaves deficient at Cu < 5.08 mg/kg DM

<u>Important note</u>: The a/m database was prepared to fit Dutch conditions (low transpiration and low EC of the water). Some modifications may be required to correspond to your local conditions.

Sources: N. Straver. Nutrient solutions for vegetables and flowers grown in water or substrates. 10th Ed. 1994.C. de Kreij, Sonneveld C., Warmenhoven M.G. and Straver N. A guide values for nutrient element contents of vegetables and flowers under glass. 3rd Ed. 1992.

Macro-elements removed by 1 ton marketable product (kg/ton)

Ν	4.0	P	1.0
К	6.0	Ca	1.0
Mg	1.3	S	1.0

Source: Kinoch, Volhoubare landbouw, RSA. Processed by Frans Lourens.

Cucumbers: Mineral ana	lysis values in	leaves	
Ν	2.90%	Fe	140 ppm
S	0.30%	Al	90 ppm
Р	0.52%	Mn	115 ppm
К	2.90%	В	45 ppm
Mg	0.54%	Cu	16 ppm
Са	2.20%	Zn	35 ppm
Na	0.08%	Мо	

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