

# Standard Nutrient Solution Tomato

Monitoring results and evaluation during a commercial grown long term soilless grown tomato crop.

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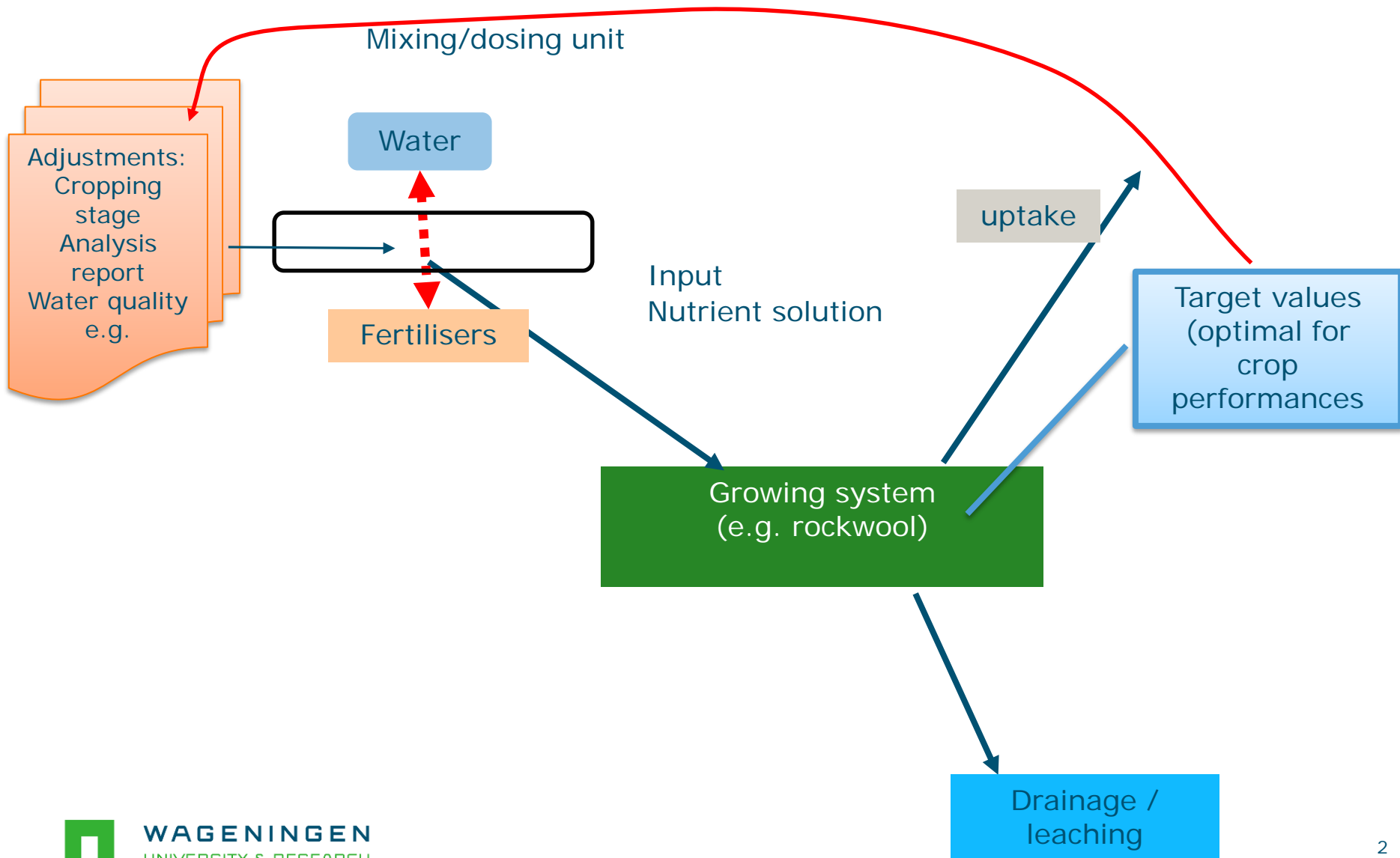
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# The Standard Nutrient solution



## The Standard Nutrient Solution

The average nutrient element concentrations to be supplied to the crop to maintain the target values of the nutrient solution in the root environment

i.e. to compensate for uptake and losses by drainage

for recycling water systems = to compensate for uptake ~~and losses by drainage~~

# Research question

- Developments since early 80-ies:
  - New varieties
  - High wire cropping system
  - Recirculation
  - (Artificial lighting)
  - Production doubled !
- Use of rootstocks
- Tomato types / varieties
- Is the standard nutrient solution still applicable ?
- What do we know about nutrient uptake during cycle

# Set up

- Monitoring at long term commercial crops
- Lighted / non-lighted
- Weekly analysis of drainage and irrigation solution
- Recording fertiliser usage
- Plant monitoring
- biomass collection
  - Leaf, side shoot prunings, Yield, crop residual
  - dry matter analysis





# Results

Data : weekly and average

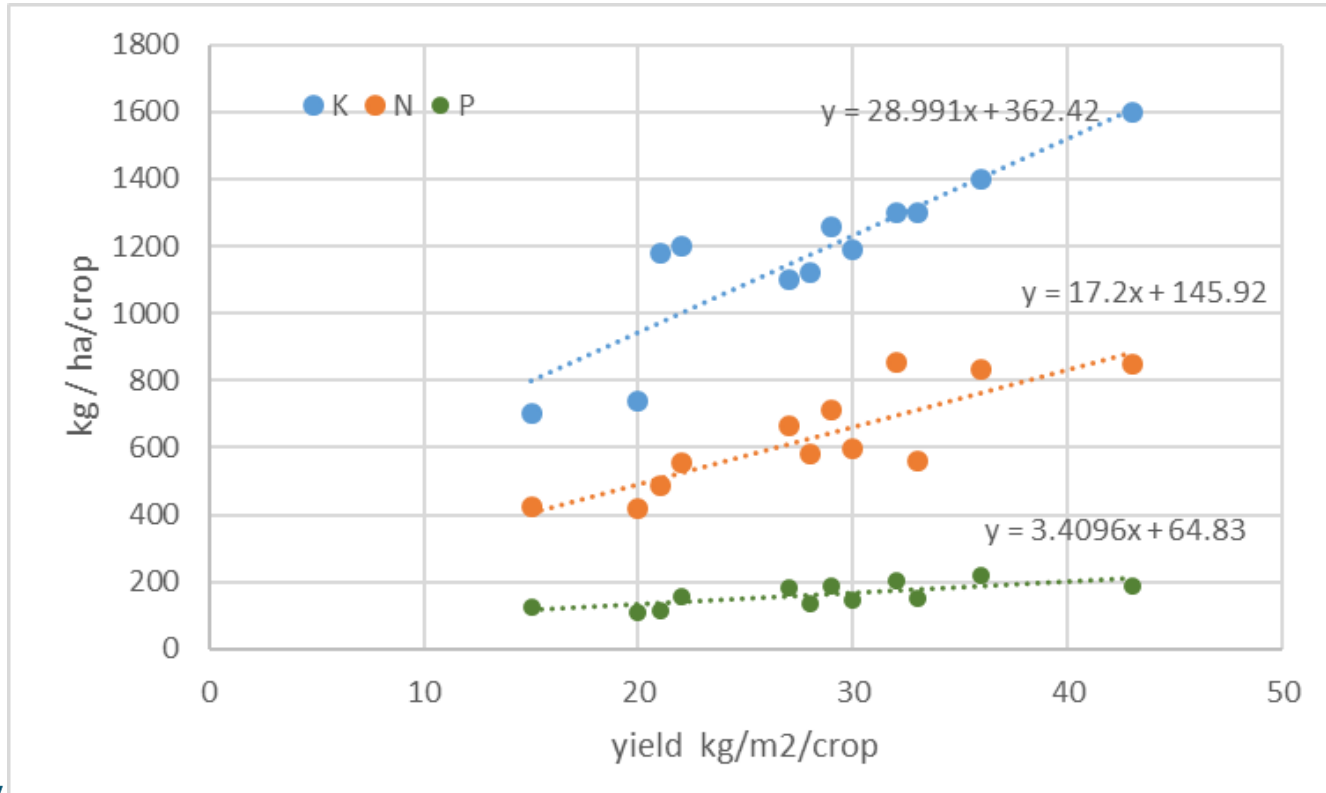
- nutrient supply ( fertiliser recipes)
- supply ( irrigation analysis)
- root environment ( drainage)
- uptake via waterflows (supply-drain)
- uptake via biomass
  - Total biomass
  - Backward extrapolation of crop monitoring

■ “Model”

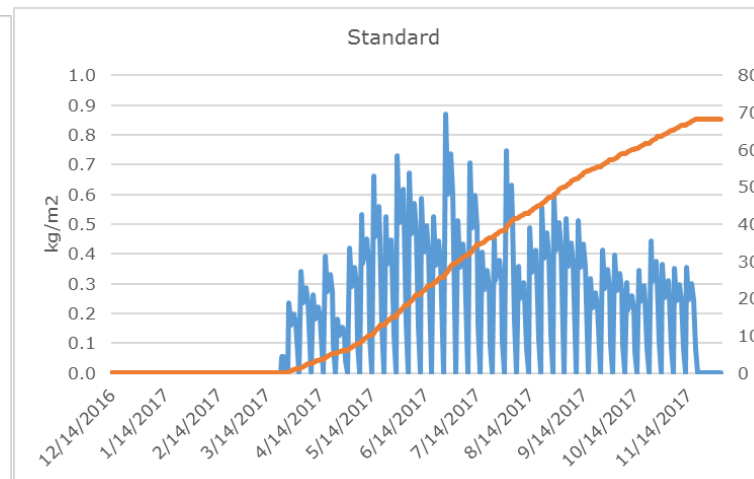
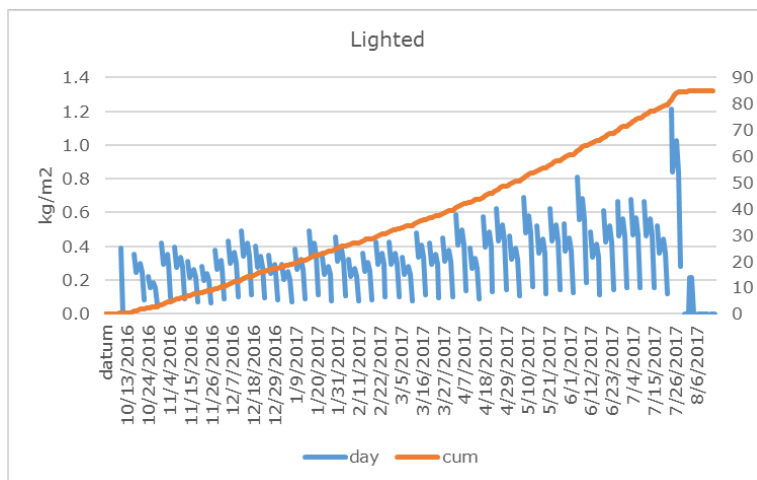
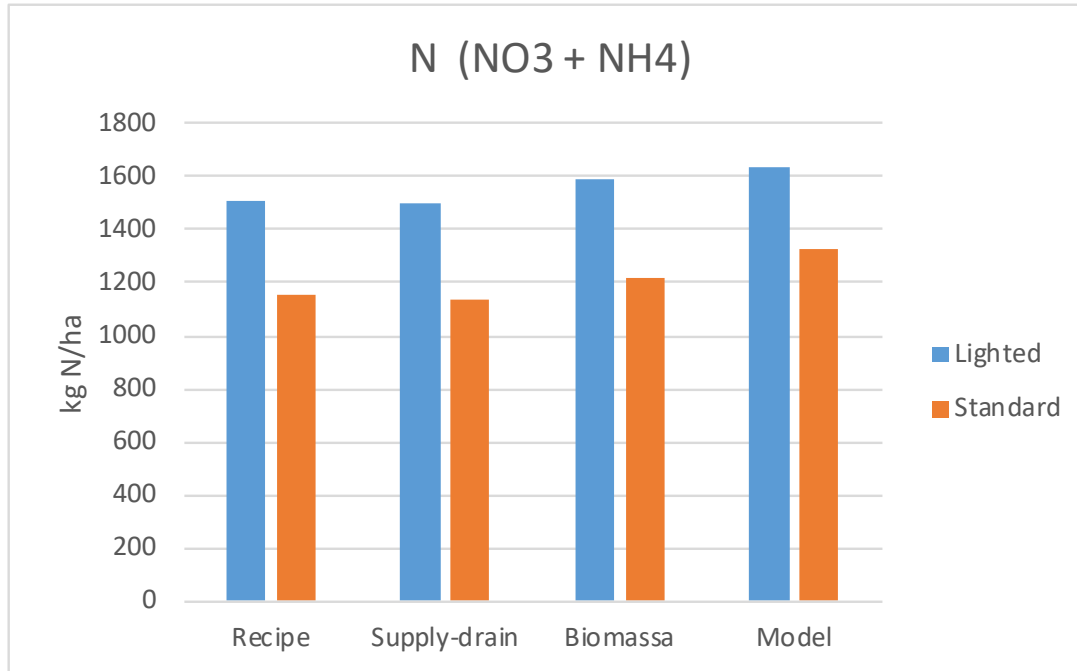


# The uptake "model"

- Total uptake calculated from experiments (data '80s – '90s)
- Linear regression between fruit yield and uptake

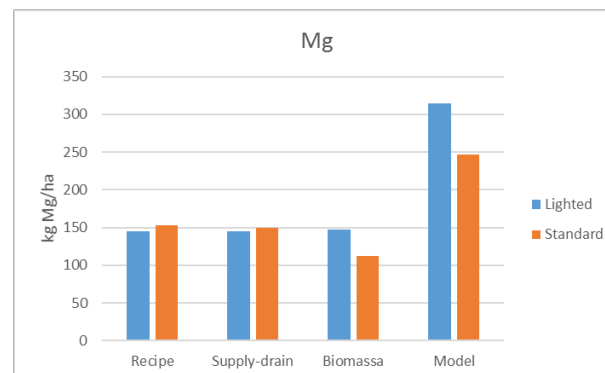
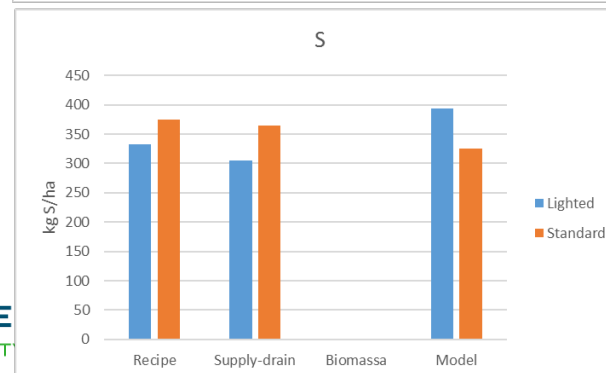
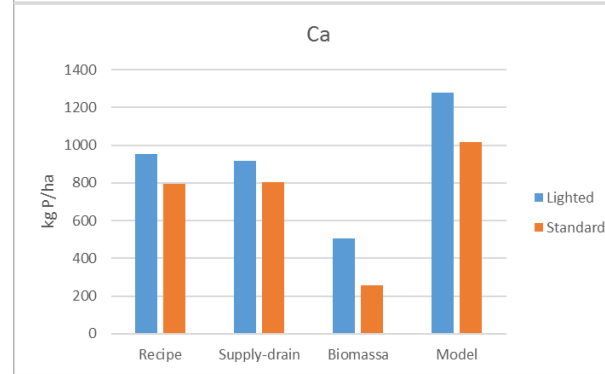
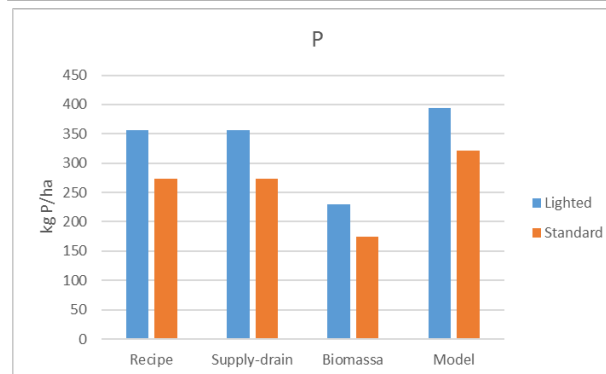
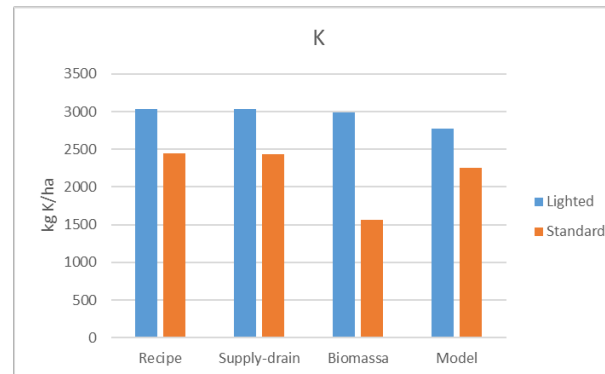
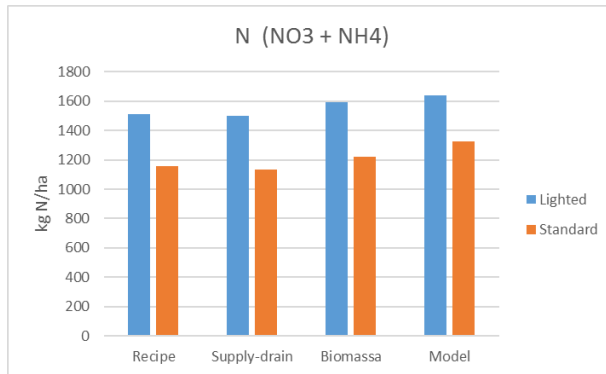


# Total uptake (via waterfow)

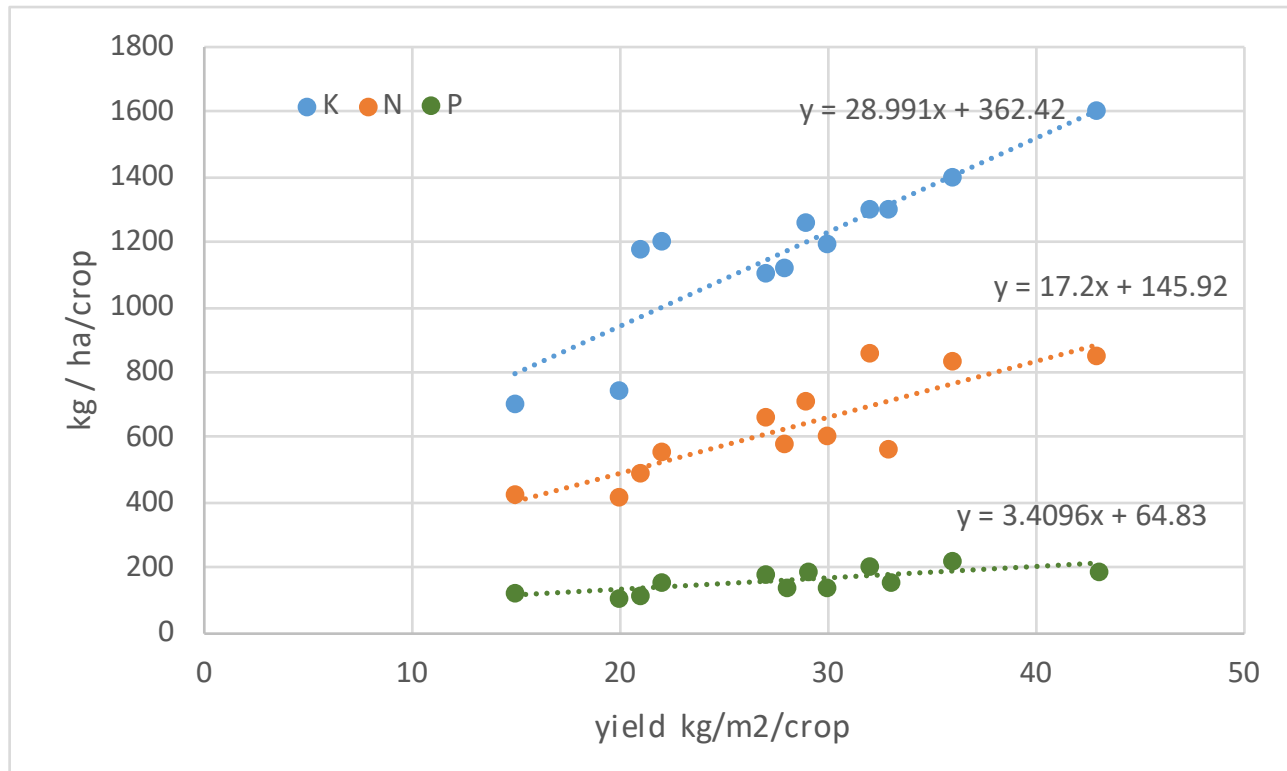




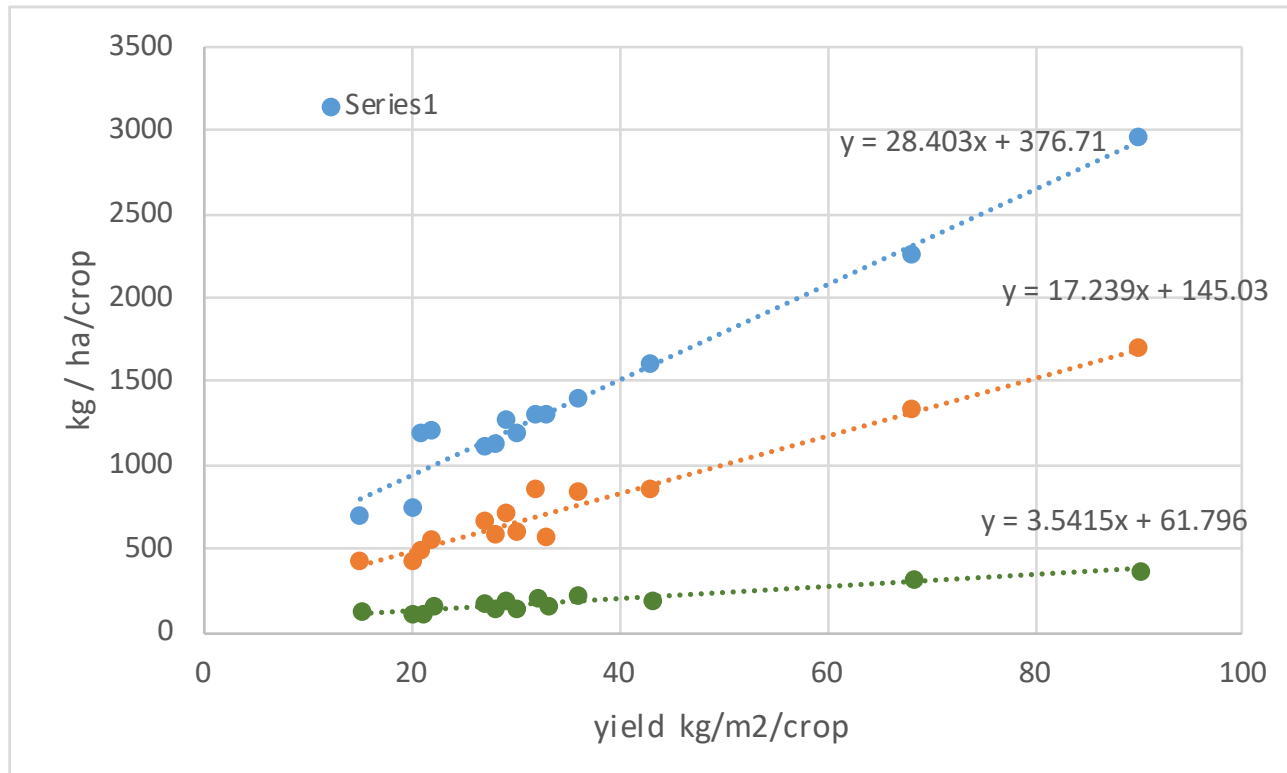
# All macro's



# Comparison with the uptake 'model'

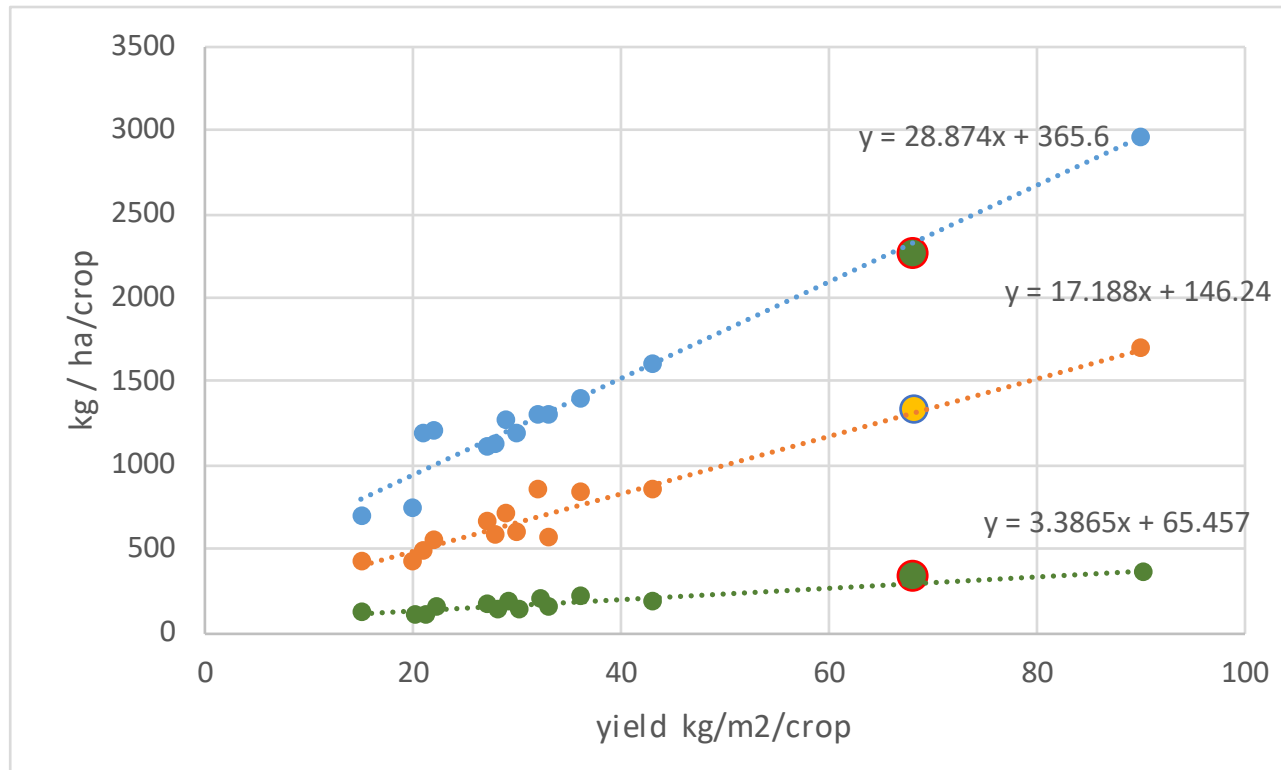


# Comparison with the uptake 'model'

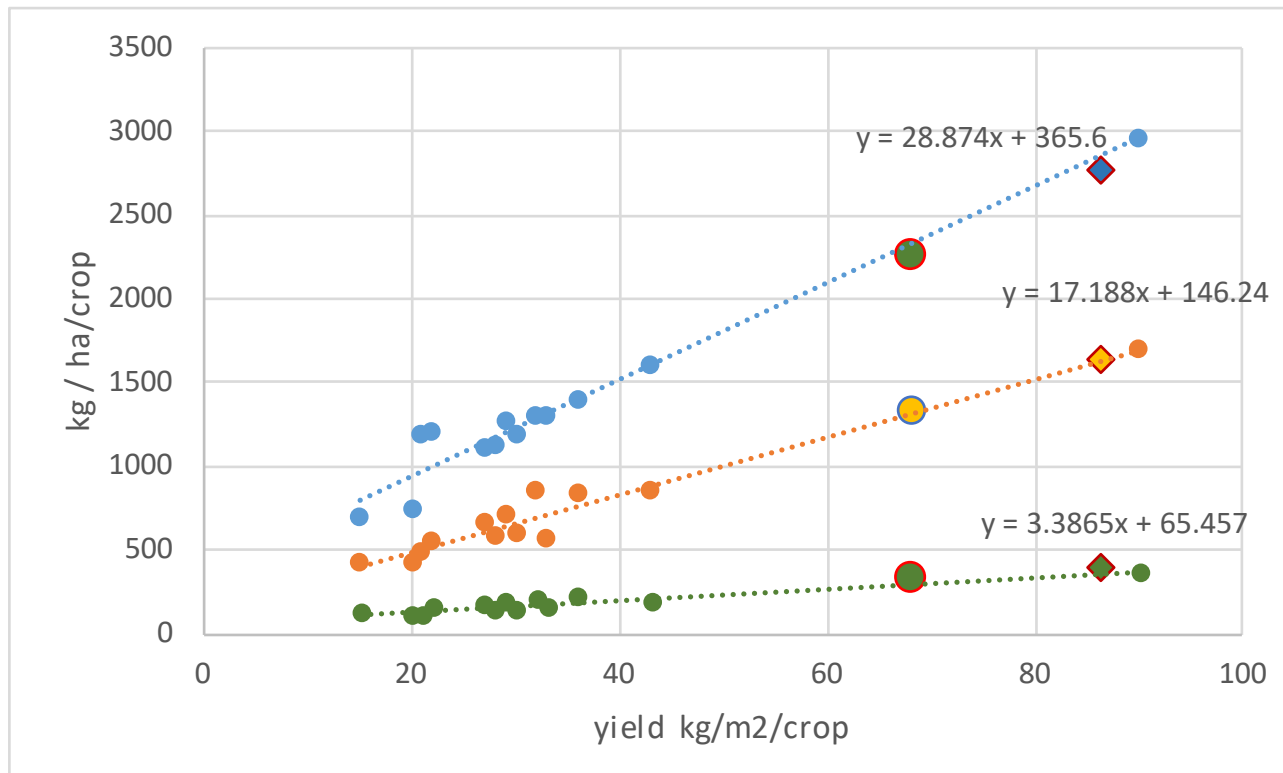


Extrapolation to 90 kg.m2

# Comparison with the uptake 'model'



Adding data from "standard crop" ; 68 kg/m<sup>2</sup>



Adding data from "standard crop" ; 68 kg/m<sup>2</sup>  
and lighted crop 89 kg/m<sup>2</sup>

# The nutrient solution supplied

Waterbalance	Standard	Lighted
Ttotal water supply	1069	1282
drain	369	427
drain %	34%	33%
Water uptake	700	855

## Drip irrigation

	Stand.	Lighted	BAB
EC	2.5	2.5	2.6
NH <sub>4</sub>	0.4	0.5	1.2
K	8.0	7.9	9.5
Ca	5.1	4.9	5.4
Mg	2.5	2.4	2.4
Na	1.8	1.7	
NO <sub>3</sub>	11.5	12.3	12.5
Cl	4.8	4.7	3.5
SO <sub>4</sub>	3.9	3.3	4.4
H <sub>2</sub> PO <sub>4</sub>	1.1	1.0	1.5
Fe	21.6	26.4	15.0
Mn	9.8	12.0	10.0
Zn	11.1	11.9	5.0
B	86.4	76.7	30.0
Cu	1.7	1.6	0.8
Mo	2.7	2.7	0.5



# Drainage concentration

	Stand.	Lighted	BAB
EC	4.01	3.95	3.7
NH4	0.11	0.11	0.1
K	6.30	5.62	8
Ca	9.40	9.09	10
Mg	5.42	5.60	4.5
Na	5.04	5.06	<8
NO3	12.34	13.23	16
Cl	9.88	10.34	6
SO4	8.11	7.40	6.8
H2PO4	0.70	0.46	1
Fe	27.30	24.57	25
Mn	5.27	5.72	7
Zn	22.06	30.48	7
B	195.34	183.45	50
Cu	3.31	2.98	0.7
Mo	6.22	6.05	0.5

# Recipe

	Average supplied		
	Standard	Lighted	BAB
EC	1.75	1.72	1.5
NH4	0.76	0.77	1
K	8.95	9.08	6.5
Ca	2.83	2.77	2.75
Mg	0.90	0.76	1
Na	0.09	0.07	0
NO3	11.02	11.82	10.25
Cl	2.13	1.88	0.5
SO4	1.67	1.21	1.5
H2PO4	1.26	1.34	1.25
Fe	18.68	27.31	15
Mn	12.14	15.15	10
Zn	5.38	2.57	4
B	29.08	23.48	20
Cu	0.85	0.89	0.75
Mo	0.86	3.23	0.5

# Recipe II Recalculated to equal EC

	Standard	Average supplied		
		Lighted	BAB	
EC	1.5	1.5	<b>1.5</b>	
NH4	0.7	0.7	<b>1</b>	
K	7.7	7.9	<b>6.5</b>	
Ca	2.4	2.4	<b>2.75</b>	
Mg	0.8	0.7	<b>1</b>	
Na	0.1	0.1	<b>0</b>	
	0.0	0.0		
NO3	9.4	10.3	<b>10.25</b>	
Cl	1.8	1.6	<b>0.5</b>	
SO4	1.4	1.1	<b>1.5</b>	
H2PO4	1.1	1.2	<b>1.25</b>	
	0.0	0.0		
Fe	16.0	23.8	<b>15</b>	
Mn	10.4	13.2	<b>10</b>	
Zn	4.6	2.2	<b>4</b>	
B	24.9	20.4	<b>20</b>	
Cu	0.7	0.8	<b>0.75</b>	
Mo	0.7	2.8	<b>0.5</b>	

# Conclusions

- Uptake ratios of tomato)\* are independent of yield level
- No major changes due to modern cropping systems
- Standard nutrient solution for tomato, established in early 80-ies still can be used as basic.

Some increase in K is recommended

- )\* *crops > 4 months*



# Questions ?

