



On Farm Evaluation of Polyhalite - A Promising Fertilizer for Nutrient Management in Greenhouse Tomatoes

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Desalination Effect of Water Quality

WATER-QUALITY PARAMETERS AFTER DESALINATION

Parameter	Water from Ashkelon desalination plant	Recommendation for domestic and agricultural usage
EC (dS/m)	0.2–0.3	<0.3
[Cl ⁻] (mg/liter)	15–20	<20
[Na ⁺] (mg/liter)	9–10	<20
[Ca ²⁺] (mg/liter)	40–46	32–48*
[Mg ²⁺] (mg/liter)	0	12–18
[SO ₄ ²⁻ -S] (mg/liter)	20–25	>30
[B] (mg/liter)	0.2–0.3	0.2–0.3
Alkalinity (mg/liter as CaCO ₃)	48–52	>80*
CCPP (mg/liter as CaCO ₃)	0.7–1.0	3–10*
pH	8.0–8.2	<8.5*

*Value based on the new Israeli recommendations for desalinated water.

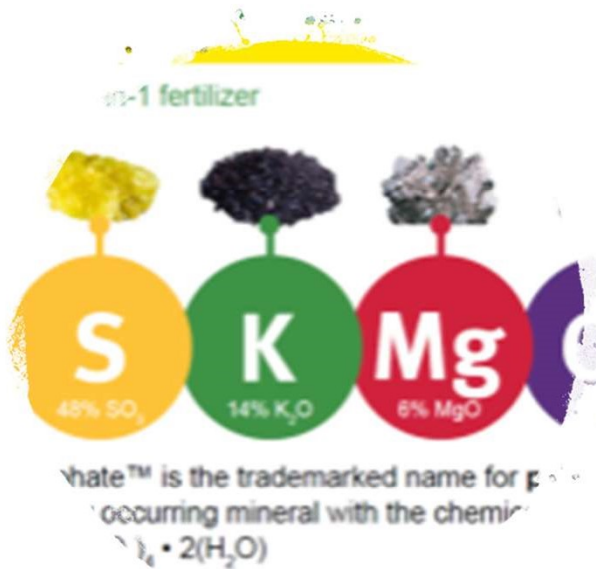
Hadera (130) since 12/09

Sorek (150) since 2013

Palmachim (60) since 09/07

Ashdod (100) since 2016

Ashkelon (110) since 12/05



Can Polysulphate™ supply the major cations and prevent magnesium and calcium deficiency symptoms such as blossom end rot? What are the advantages of this new fertilizer?

Farmer's practice



Soil Texture
Sandy Loam



July application of 40 m³ per hectare of dry manure pellets (30% chicken manure and 70% cow manure, 85% dry weight containing 2.2%, 1.64%, 2.65%, of N [organic form], P, K, respectively) was applied to the entire area.



Soil solarization and chemical disinfection (Dichloropropene and Metam sodium, 200 and 400 L ha⁻¹, respectively).

Preliminary Observation Trial in 2016

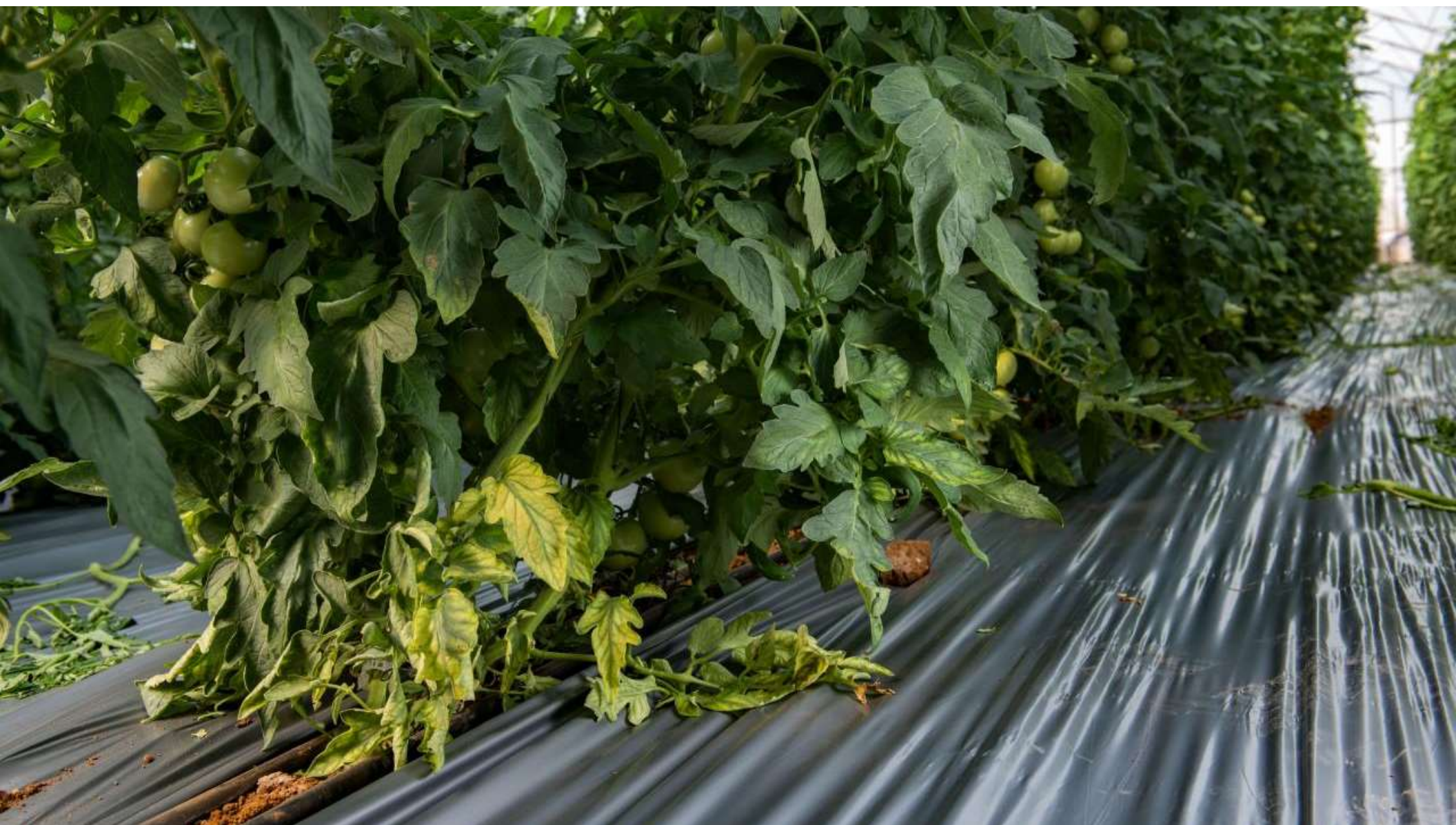
- Polysulphate
- 1.0 ton per hectare
- 1.5 tons per hectare
- 2.0 tons per hectare
- Control – without polysulphate
- Fertigation: Liquid fertilizer
Sharit Super 5-2-7.5+0.5+6



Treatment 1 control

Sharit Super 5-2-7.5 +0.5+6
without PolysulphateTM
two months after planting
10.11.2016





Treatment 2

Sharit Super 5-2-7.5 +0.5+6

1 ton / hectare PolysulphateTM



100
عدد 100
عدد 100





Treatment 3

5-2-7.5 +0.5+6 Sharit Super

1.5 tons / hectare Polysulphate™







Treatment 4

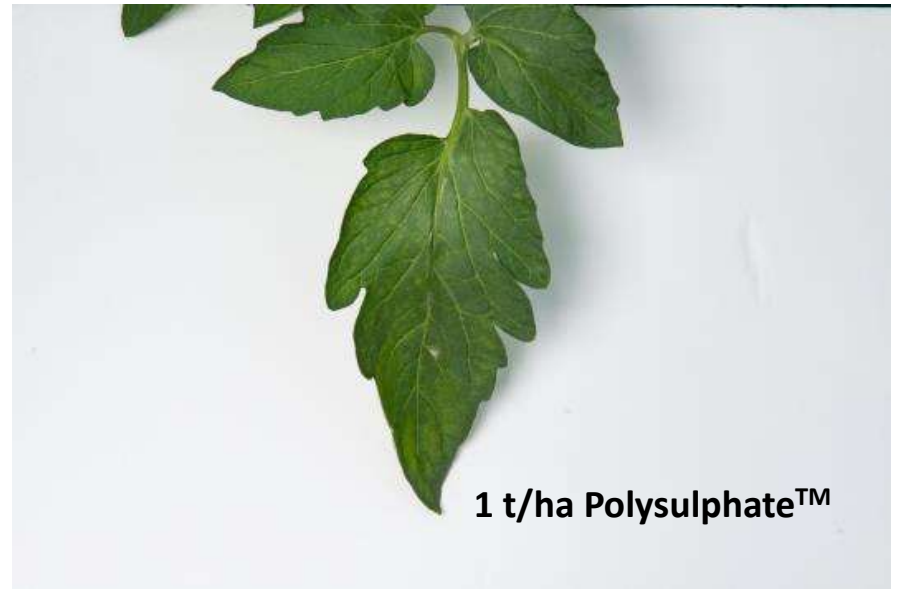
5-2-7.5 +0.5+6 Sharit Super

2 tons / hectare Polysulphate™









without Polysulphate™

1 t/ha Polysulphate™

1.5 t/ha Polysulphate™

2 t/ha Polysulphate™



15.12.2016

without Polysulphate™



1 t/ha Polysulphate™



1.5 t/ha Polysulphate™



2 t/ha Polysulphate™



16.02.2017

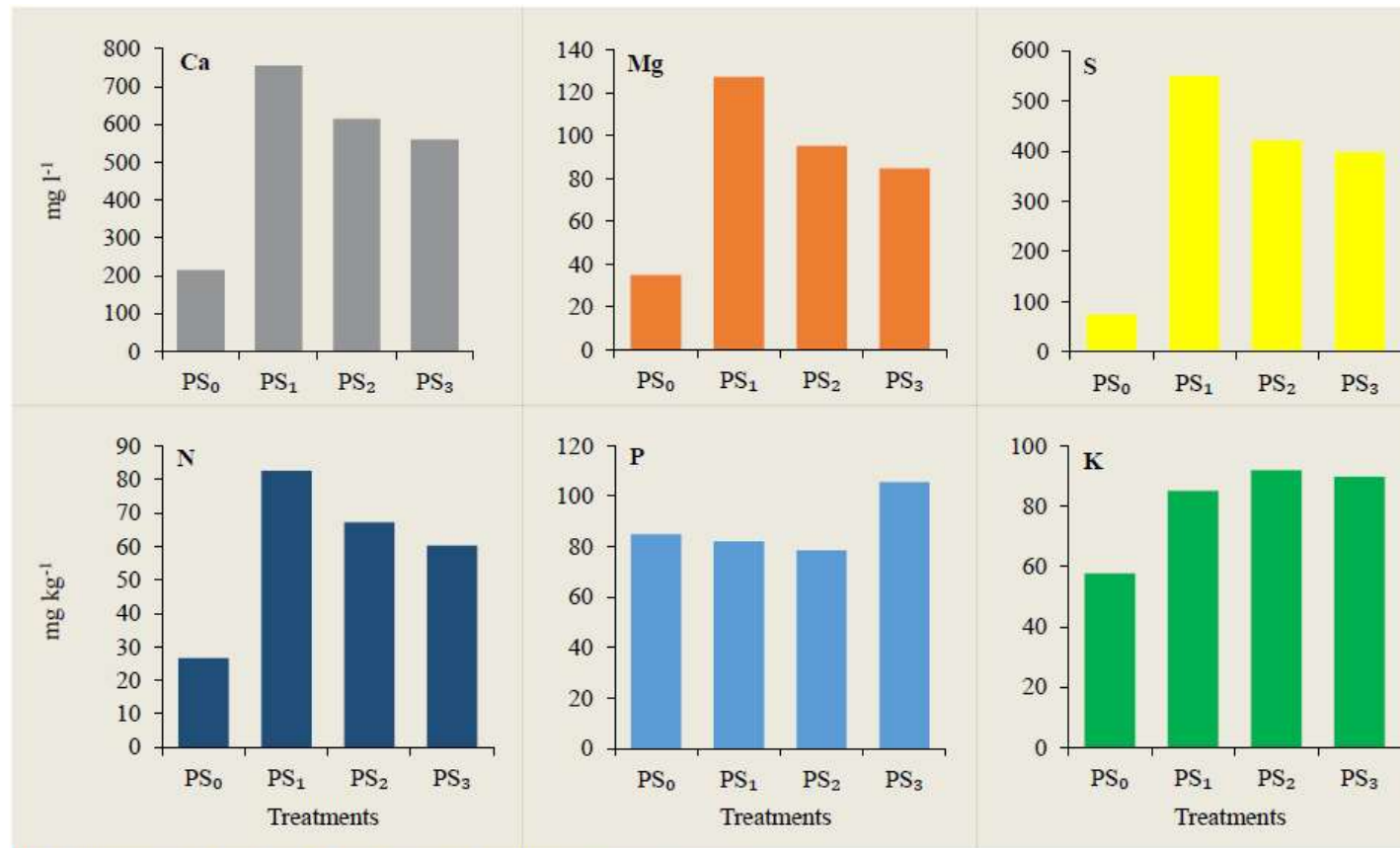
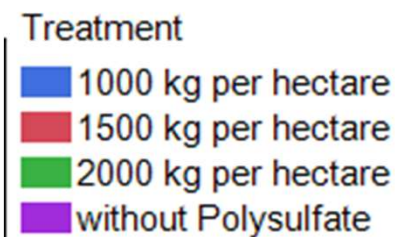
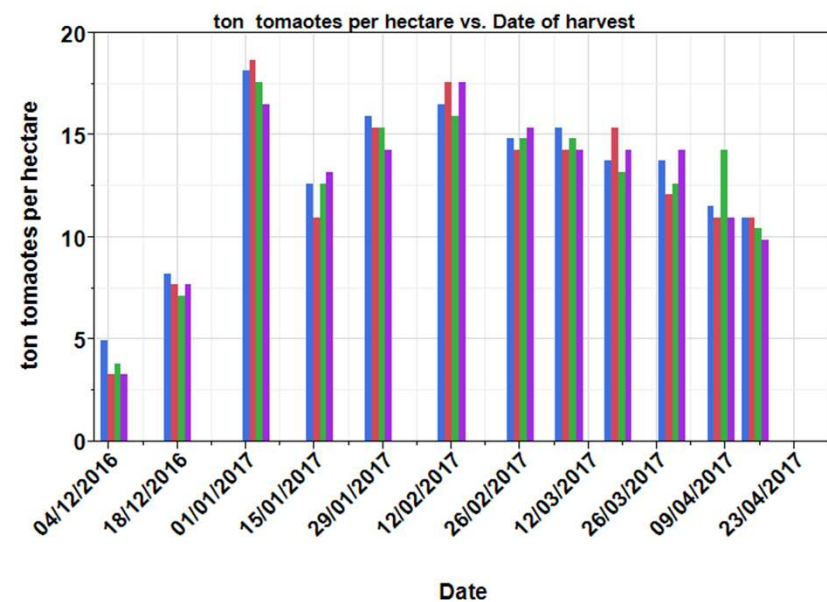
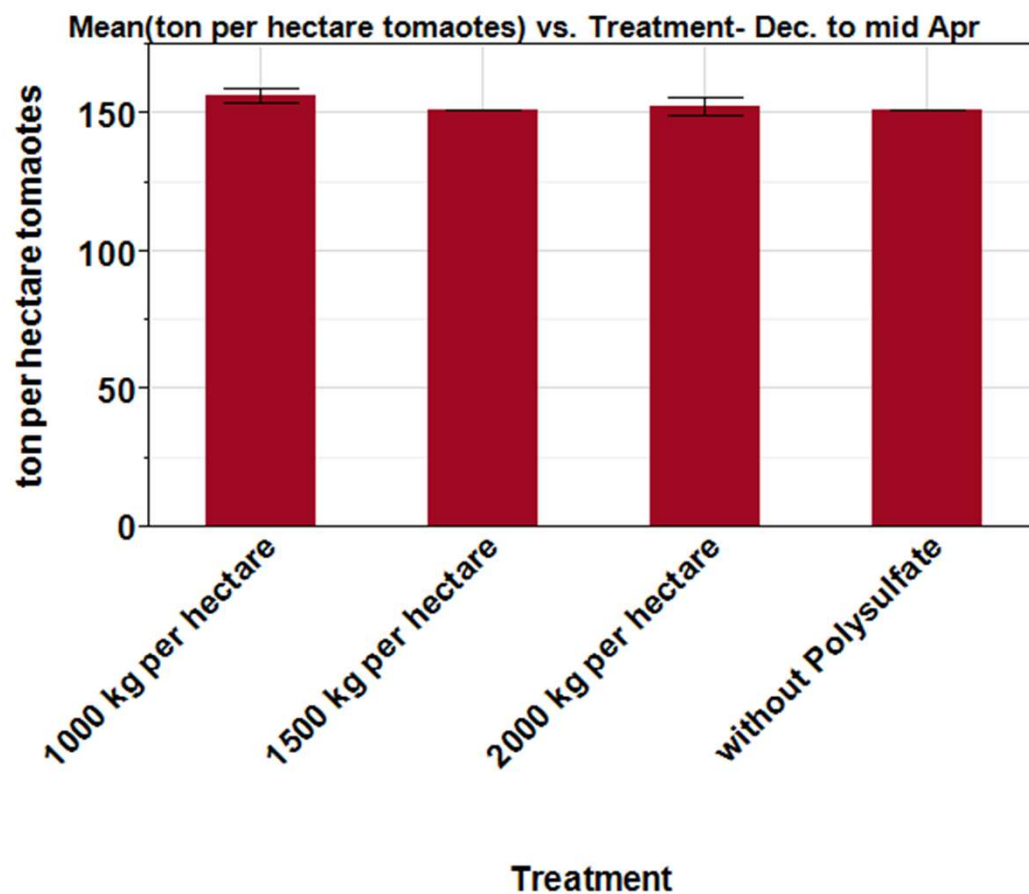


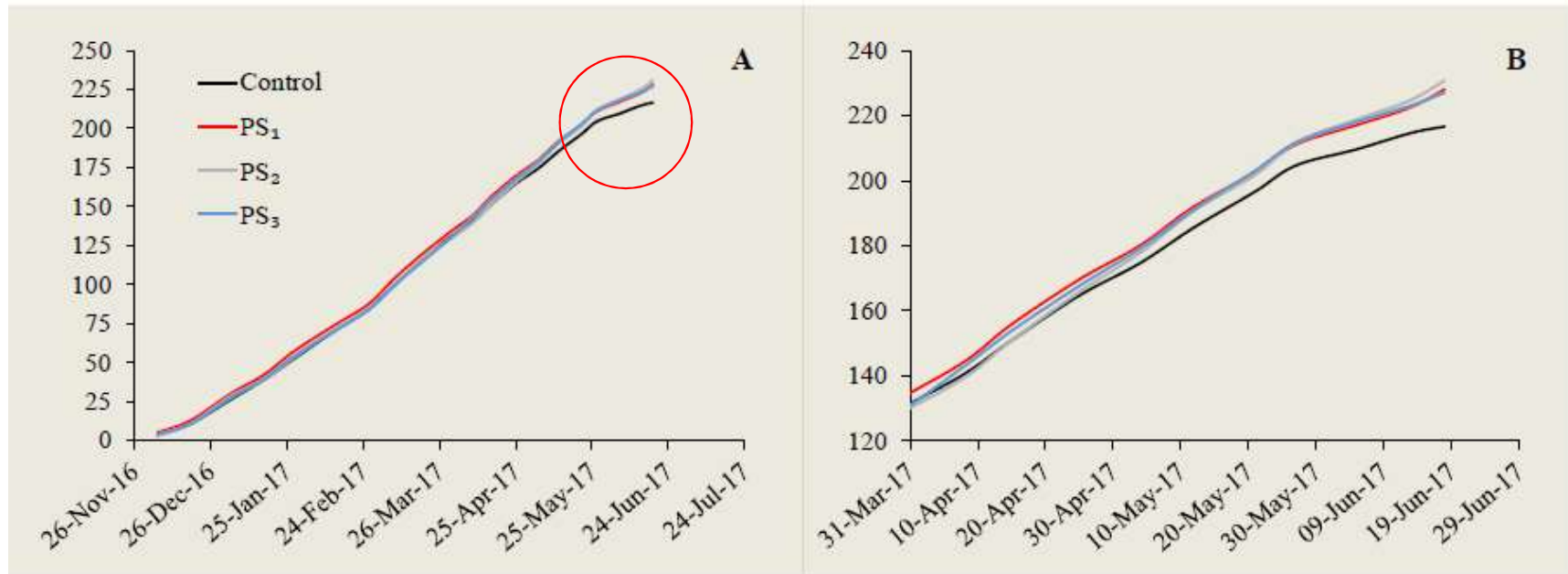
Fig. 5. Soil content of N, P, K, Ca, Mg, and S on 16 Feb 2017; five months after planting.

Soil content of N, P, K, Ca, Mg, and S on 16 Feb. 2017 five months after planting



High Quality Yield

Yield difference developed in May and June



Effects of pre-planting polyhalite application on the accumulating marketable yield of Ikram greenhouse tomatoes throughout the season (A), and during (B) (from April to June).





New experiment in
2018 -2019



Treatments – taking into consideration the K applied by Polysulphate™

1. Control - where no Polysulphate™ was applied, fertigated with Sharit Super 4-1-6+6.
 2. PS - where 1.5 Mg/ha Polysulphate™ was applied pre-planting, fertigated with Sharit Super 4-1-1+6.
 3. Control *f* - where no Polysulphate™ was applied fertigated with Sharit Super 4-1-1+6
- The fertigation began in November, about 6 weeks after planting and continued until the middle of April, a month before the end of harvest.

Farmer's practice

Cluster tomato (cv. Ikram, Syngenta, Ltd., grafted on Arnold rootstock) seedlings were planted on 20 Sep 2018, at a density of 8,330 plants per ha⁻¹. Each plant was trained to develop two branches.

At planting and during the first three months of growth the irrigation water was a mixture of desalinated water and ground water and with an EC_w range of 0.75-0.95 dS m⁻¹ with Ca, Mg, and Cl concentrations of 80, 40, and 260 ppm, respectively.

From December on the irrigation water quality improved to having an EC_w range of 0.35-0.45 dS m⁻¹ with Ca, Mg, and Cl concentrations of 40, 5, and 50 ppm, respectively.



Source of Nutrients applied	Nutrient					
	N	P ₂ O ₅	K ₂ O	CaO	MgO	SO ₃
	(kg ha ⁻¹)					
Basal application organic pellets 4 Mg/ha	75	13	108			
Fertigation - Control 11500 liters/ha 4-1-6+6	520	130	780			
Fertigation - PS/No PS 11500 liters/ha 4-1-1+6	501	125	125			
Irrigation water 580 mm (total)				403	152	81
Polysulphate 1.5 Mg/ha			210	255	90	720

Nutrient Balance						
CONTROL	546	137	888	403	152	81
Polysulphate PS	528	133	444	658	242	801
CONTROL FOR FERTIGATION (NO PS WITH REDUCED K)	528	133	234	403	152	81
<i>Estimated crop nutrient requirements</i>	<i>500</i>	<i>200</i>	<i>900</i>	<i>240</i>	<i>135</i>	<i>530</i>

Results

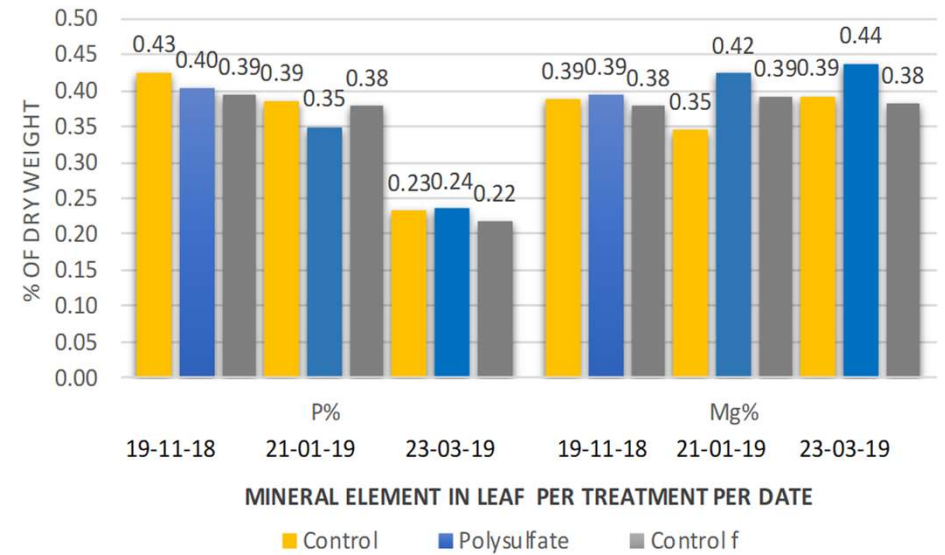
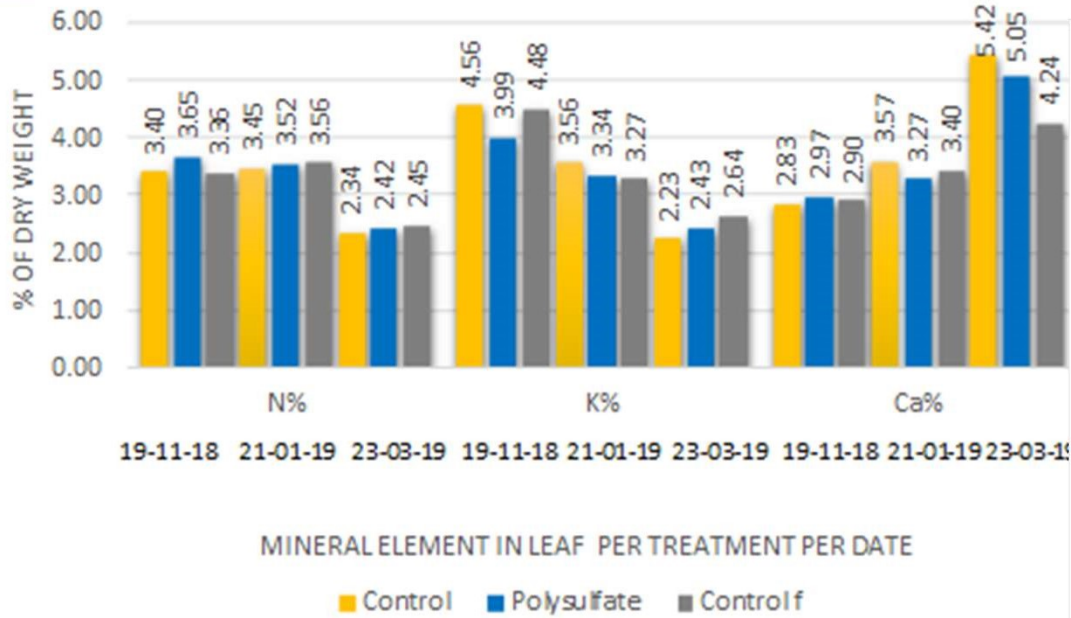


- Plant establishment and growth were normal. No symptoms of Mg deficiency, expressed as yellowing of lower leaves were apparent in any of the treatments during the first the two months of growth, probably due to the average concentration of 40 ppm Mg in the irrigation water.
- As the lower clusters of fruit approached maturity, the older leaves beneath these clusters showed minor Mg deficiency symptoms.
- In January, after the pruning of the old leaves, Mg deficiency symptoms appeared on a few plants, when the plants were heavy with developing fruit.
- By March the treatments without Polysulfate™ were showing magnesium deficiencies in the older leaves.

Effects of pre-planting polyhalite application on Yield distribution between winter and spring periods.



Harvest period	Pre-planting polyhalite rate (kg ha^{-1})		
	0	1,500	0
	Liquid fertilizer		
	6% K_2O	1% K_2O	1% K_2O
	Accumulative marketable yield (Mg ha^{-1})		
December - March	112.1	112.85	116.7
April - May	41.45	39.8	38.31
December to June (total)	153.6	152.65	155.00

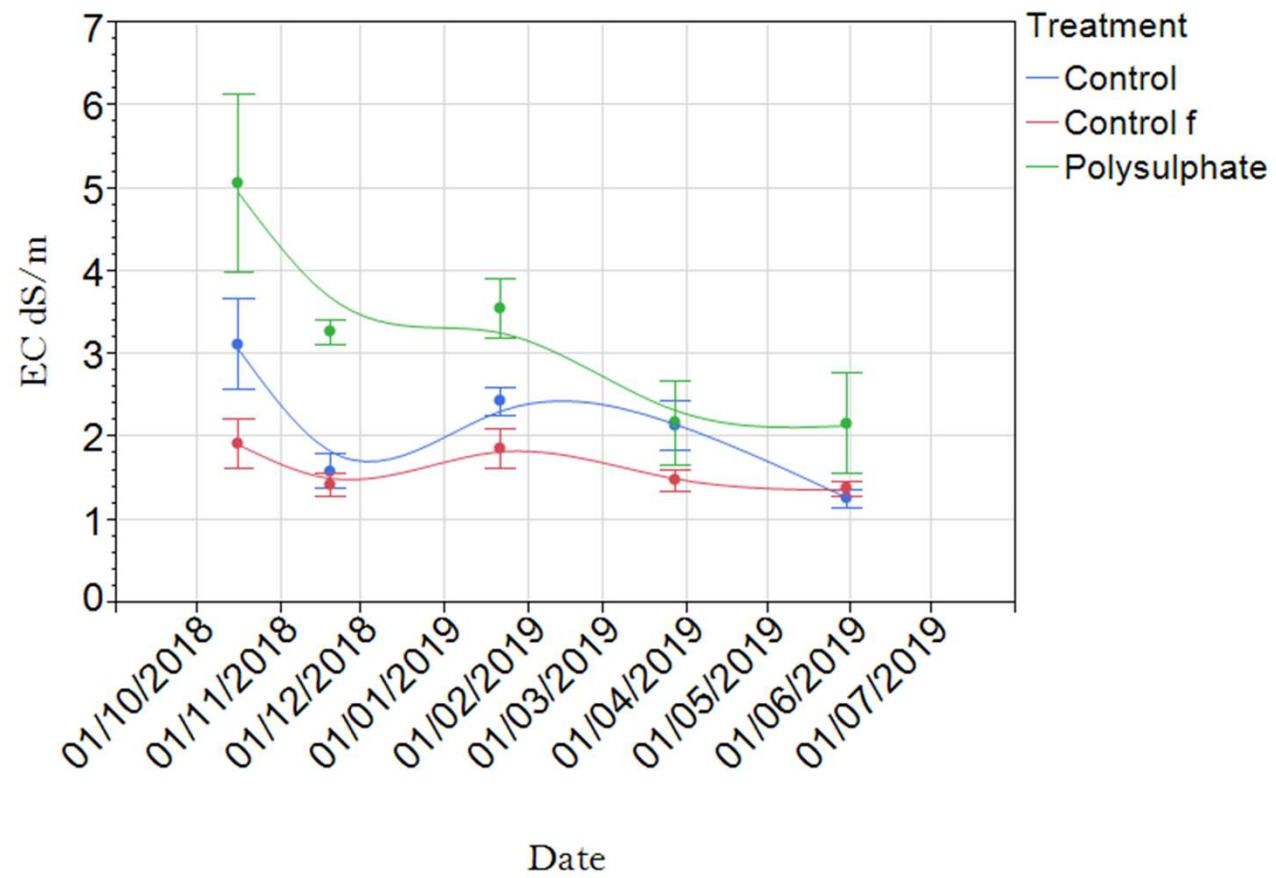


LEAF ANALYSIS

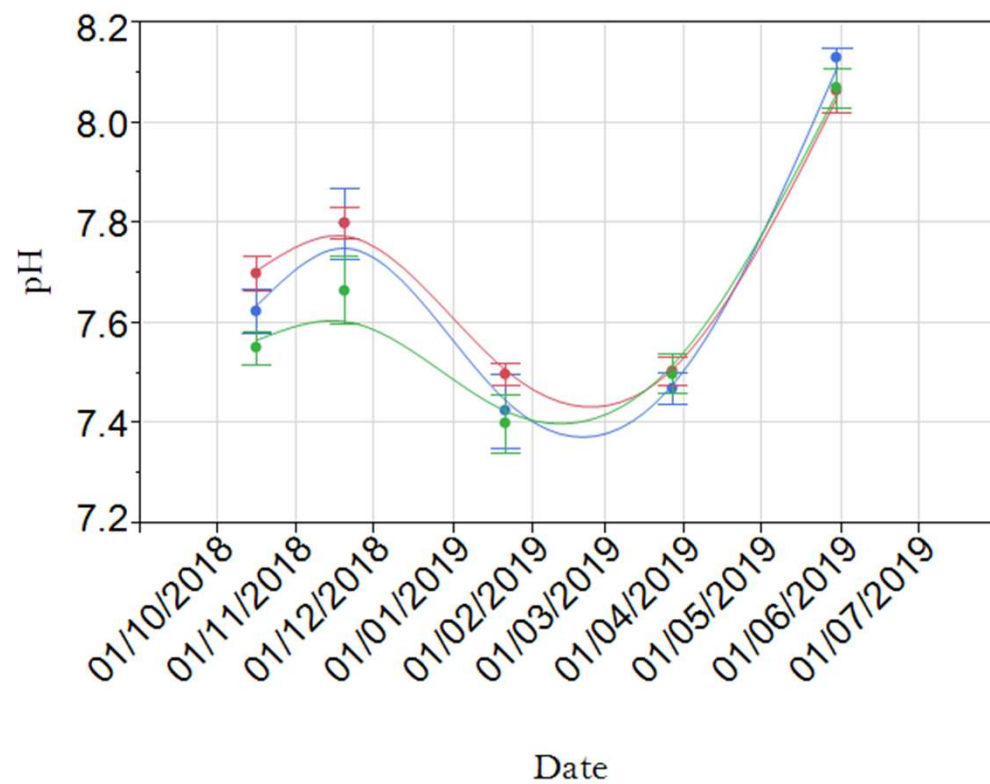
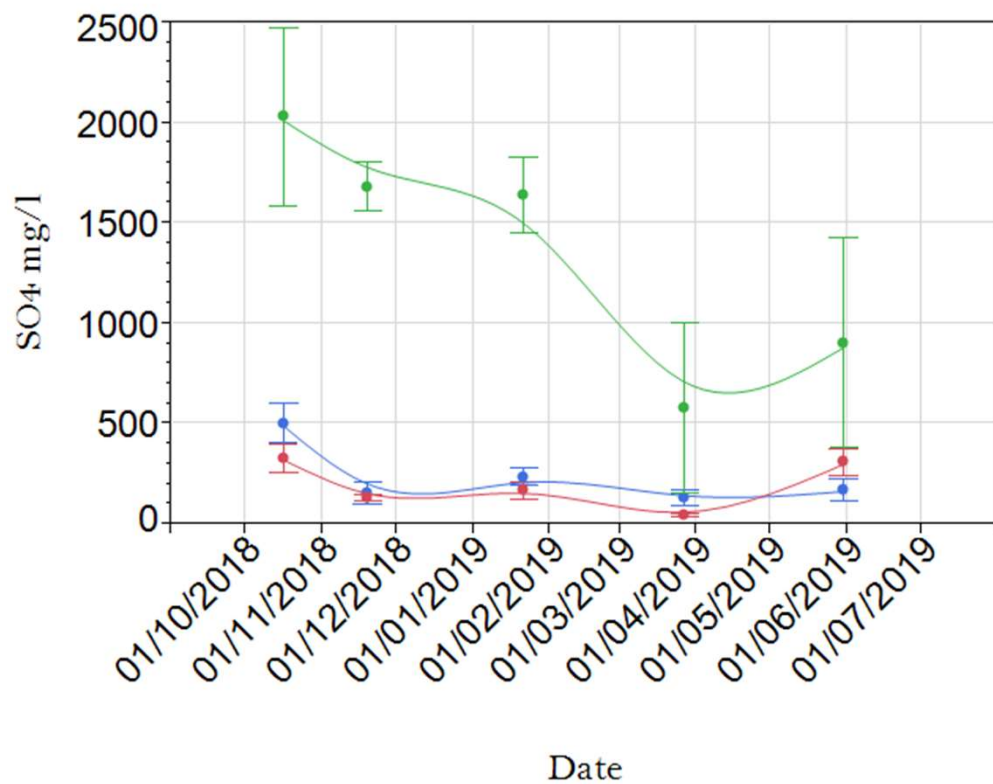




SOIL ANALYSIS



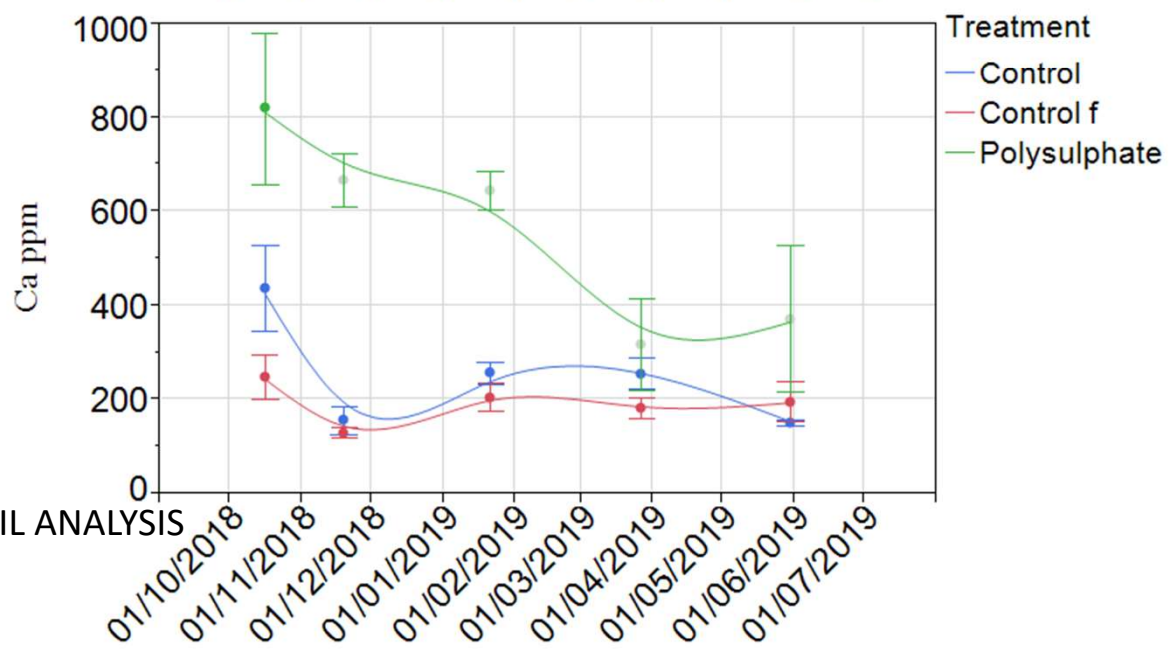
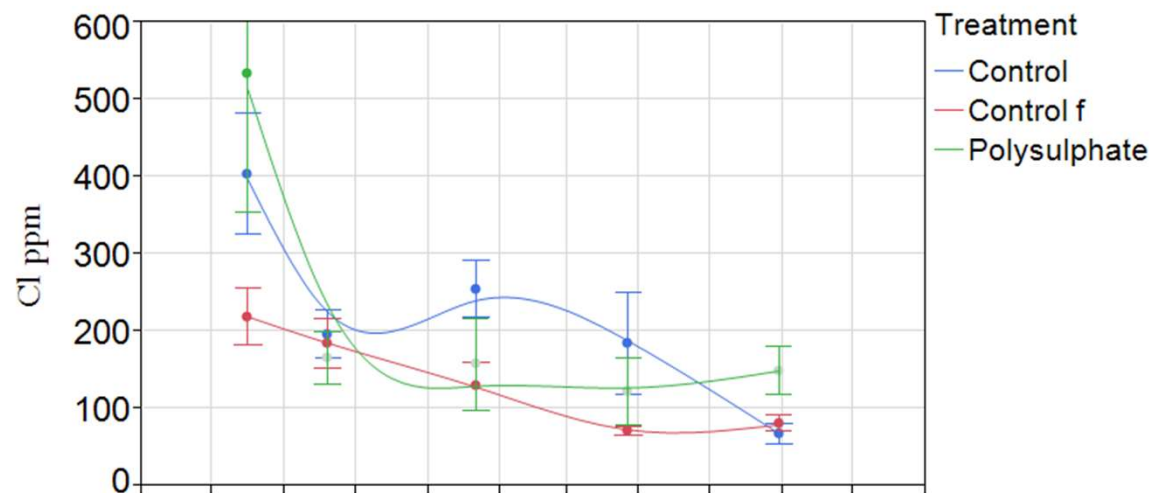
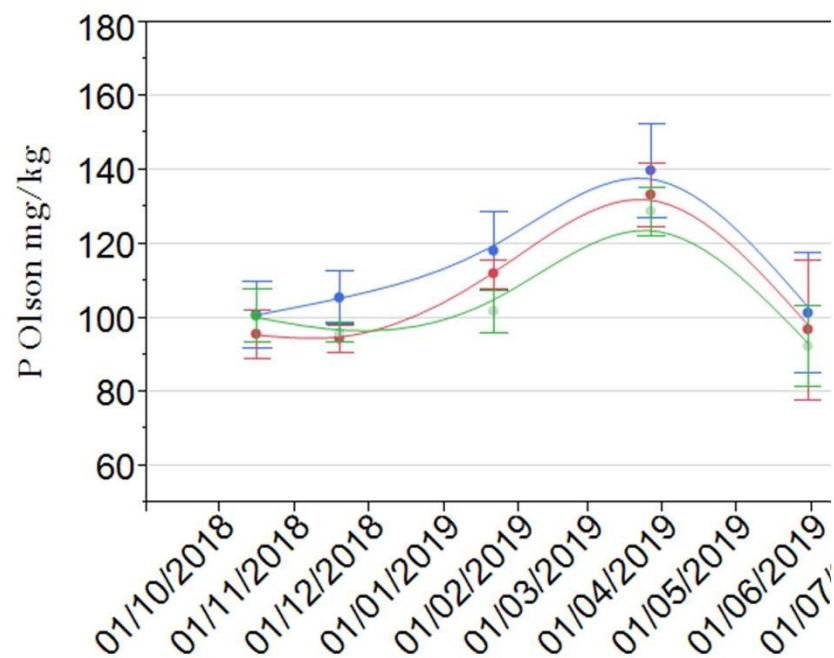
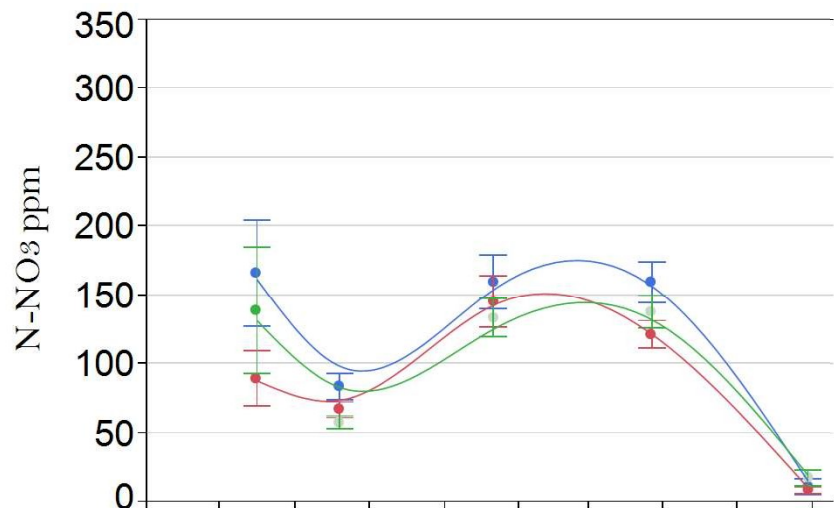
SOIL ANALYSIS

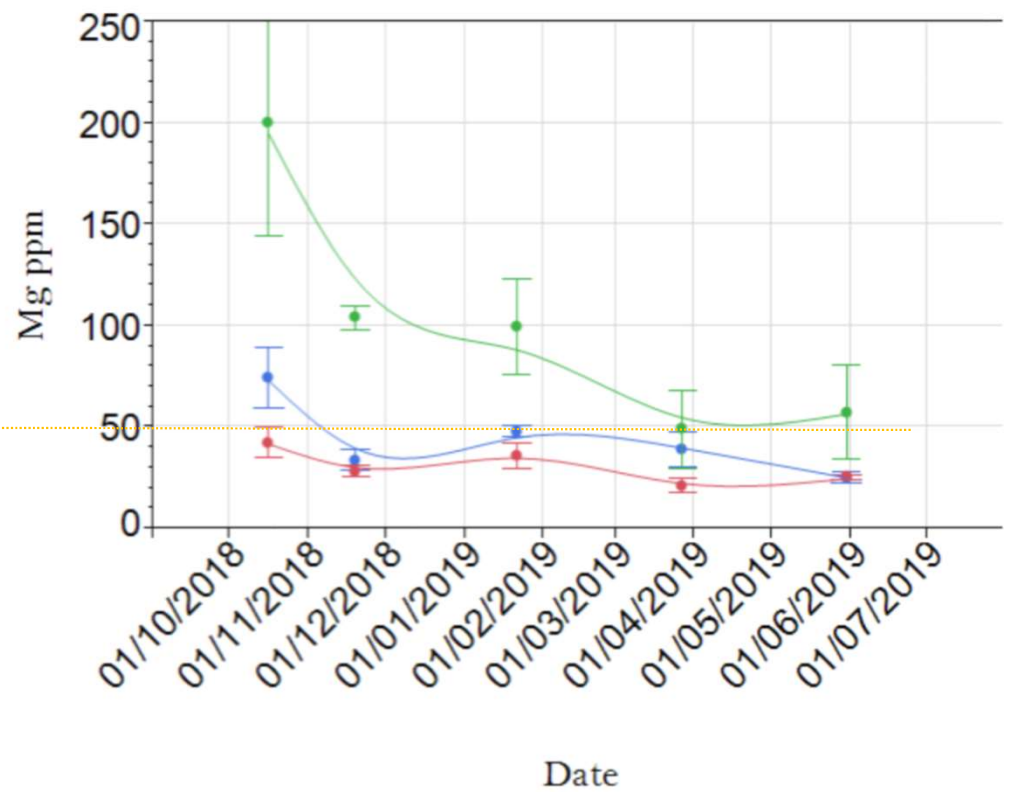
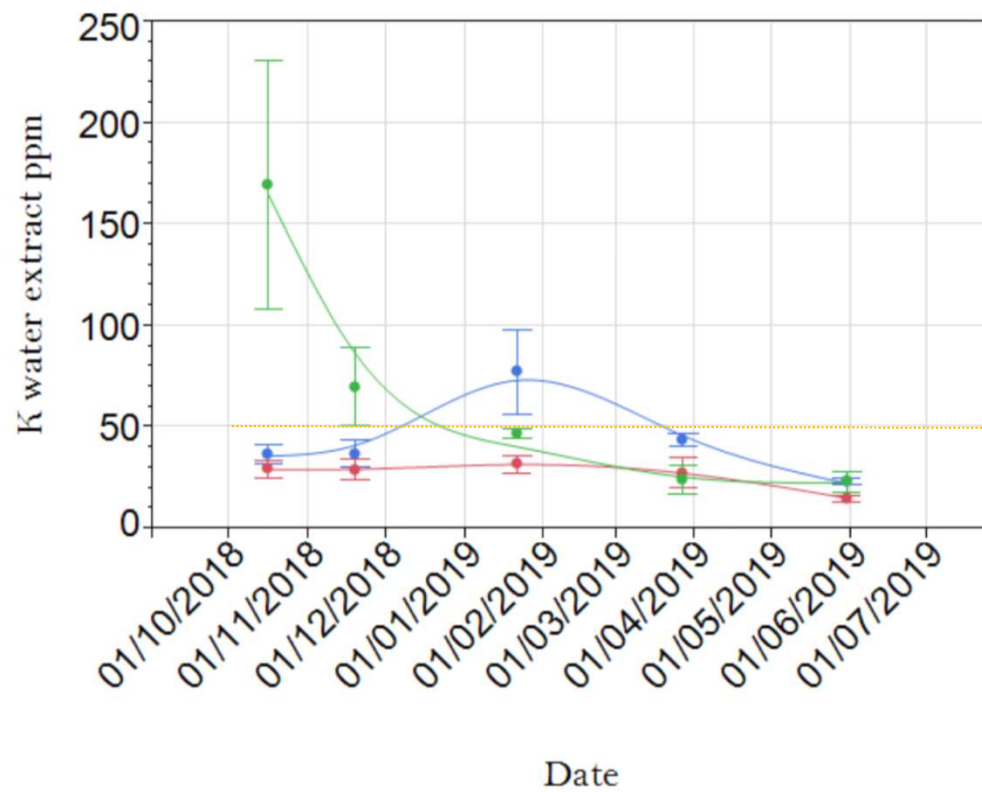


Treatment

- Control
- Control f
- Polysulphate

SOIL ANALYSIS





Treatment

- Control
- Control f
- Polysulphate

SOIL ANALYSIS

Conclusions

- The optimization of mineral nutrition during the crop season is particularly sensitive to local soil fertility, fertilizer choice and application regime, as well as irrigation water quality.
- In the case study presented, the plant response to polyhalite applied as a pre-planting fertilizer supplying S, K, Ca and Mg was positive.
- The yield and produce quality was excellent.
- Applying Polysulphate TM, while lowering the potassium applied through fertigation, considering the amount of K given to the soil from the polyhalite, decreased the fertilizer costs throughout the growing season.



THANK YOU!



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