Iceland Liechtenstein Norway grants

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Utilization of treated geothermal water for plant irrigation – polish experiences

Wykorzystanie uzdatnionych wód geotermalnych dla nawadniania upraw – polskie doświadczenia

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- **Using greenhouses system**
- **Irrigation Drip System**
- **Scheduling Irrigation - 4 times/day**
- **Salinity Control**
- **pH measurement**
- **Organic Nutrients**

01

Preparation of the seedlings and water treatment installation

02

Adjusting the desalination plant & Treating Geothermal Water

03

Planting the seedlings and preparing 3 types of mix water

04

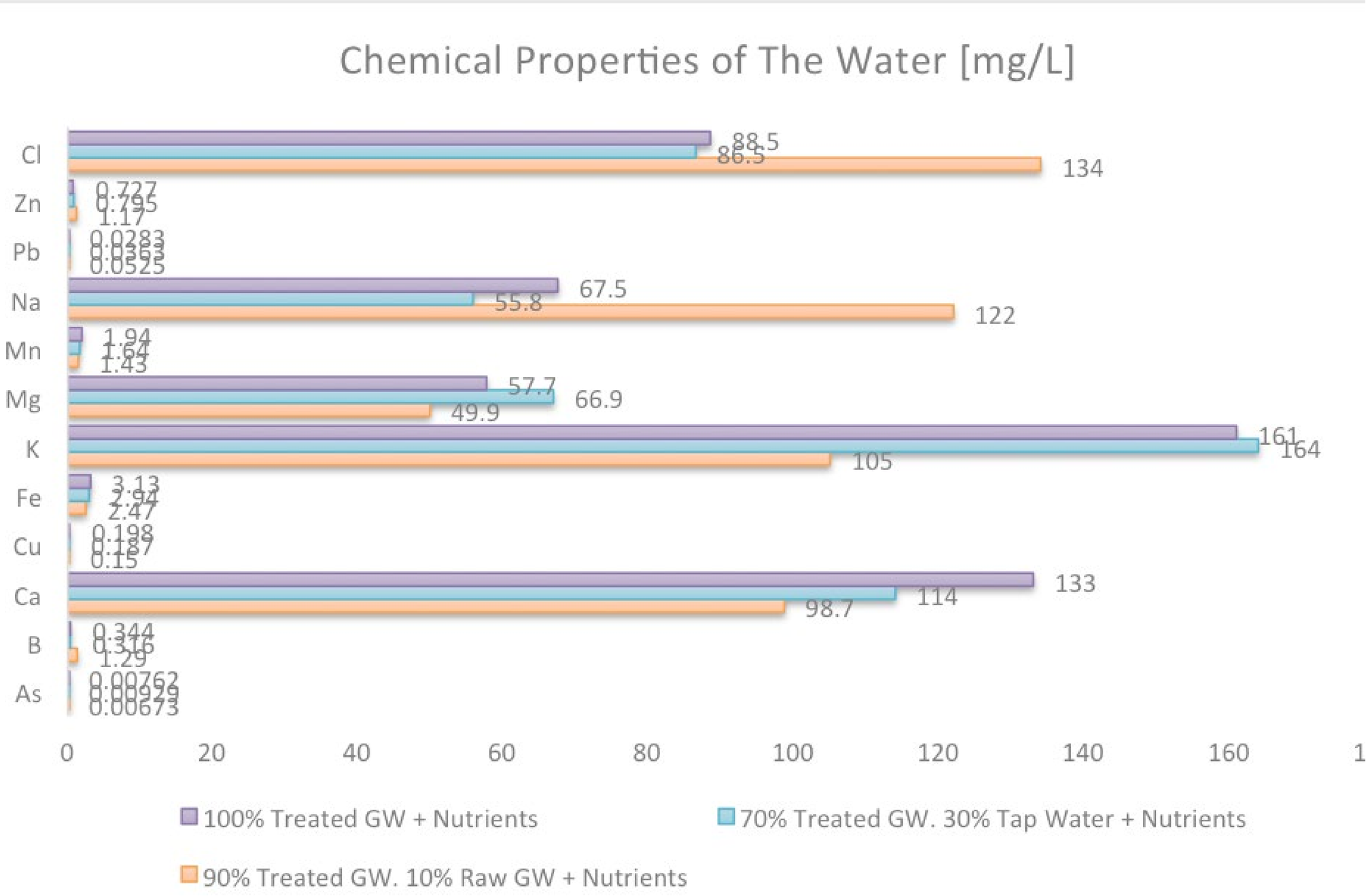
Measurement and maintanance

05

Physical and chemical analysis of water, soil, and lettuce

The mineralization of each water type is as follows:

- 628 mg/L (100% treated geothermal water)
- 593.2 mg/L (mix of 70% treated geothermal water with 30% tap water)
- 780.5 mg/L (mix of 90% treated geothermal water with 10% of raw geothermal water).



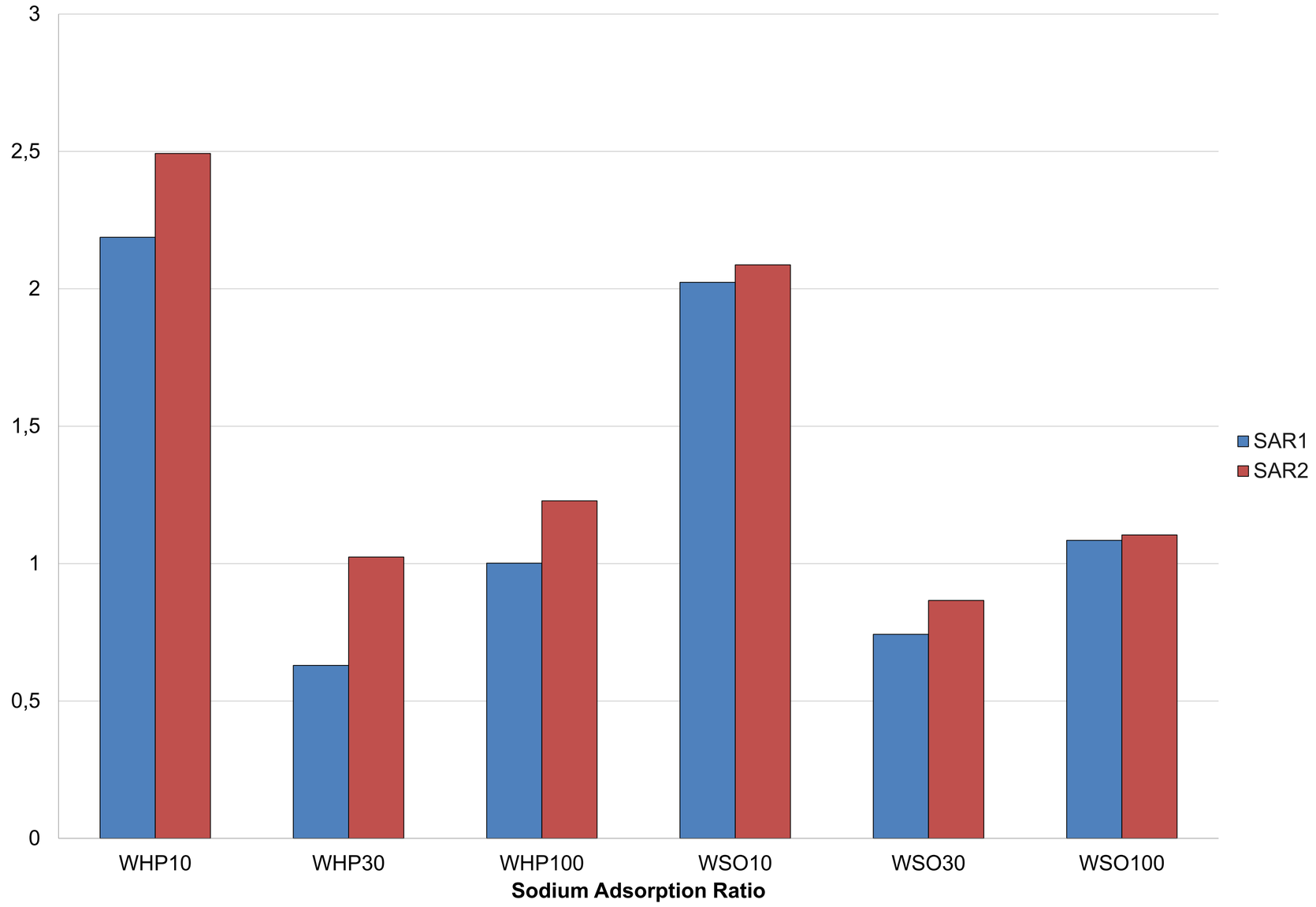
Sodium Adsorption Ratio (SAR)

Sodium hazard on soil infiltration is determined by sodium adsorption ratio (SAR)

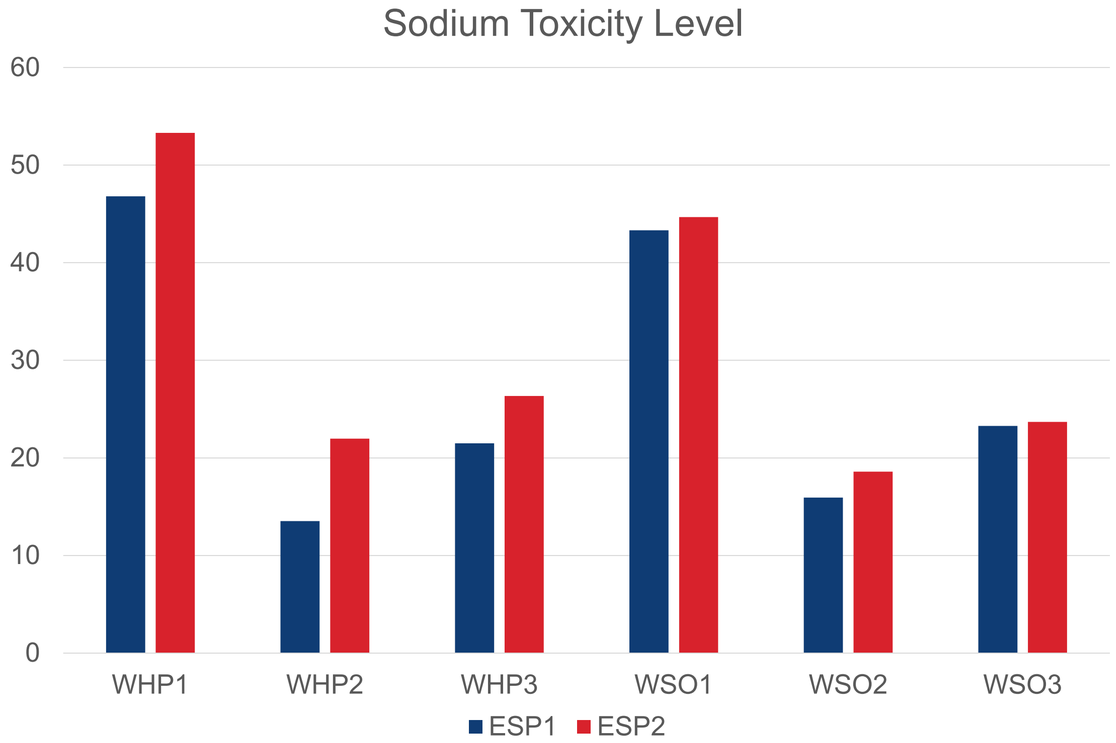
$$SAR = \frac{Na^{+}\left(\frac{meq}{L}\right)}{\sqrt{\frac{1}{2}(Mg^{2+} + Ca^{2+})\left(\frac{meq}{L}\right)}}$$

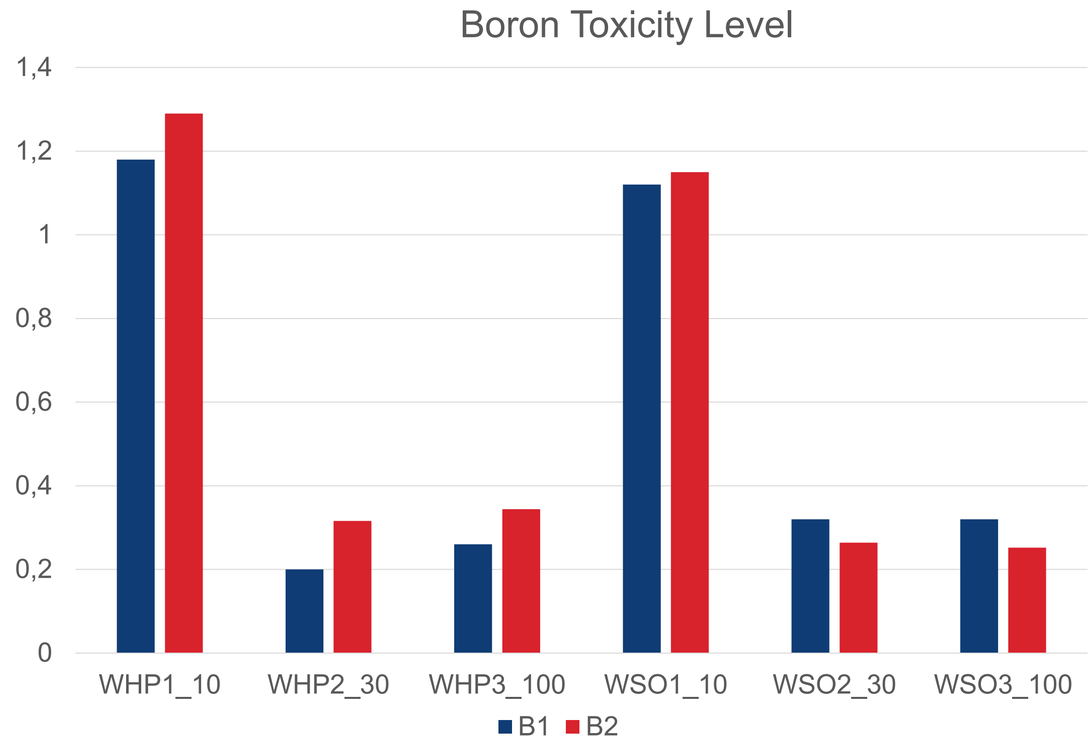
Sample ID	EC1	EC2	TDS [mg/L]
WHP1_10	1.83	1.858	768.3
WHP2_30	1.88	1.654	585.9
WHP3_100	1.98	1.766	618.3
WSO1_10	2.01	1.706	824.7
WSO2_30	1.67	1.616	542.6
WSO3_100	1.55	1.541	510.7

Salinity Hazard Analysis



Specific Ion Toxicity Analysis

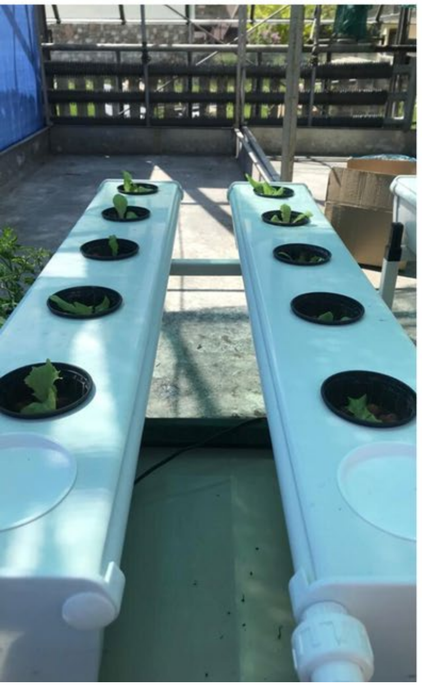


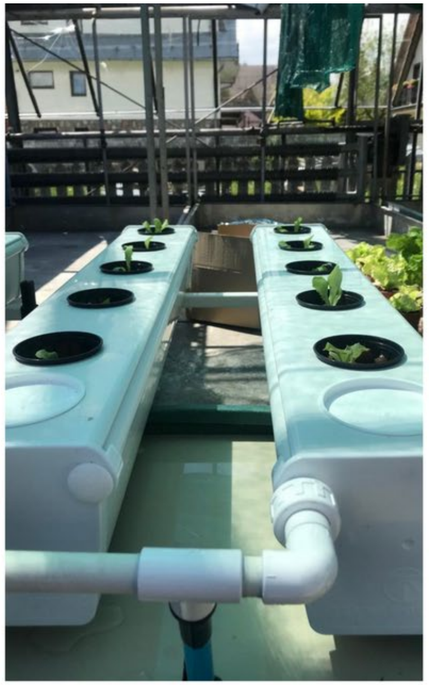


- Sodium toxicity can occur in the form of leaf burn, leaf scorch and dead tissues running along the outside edges of leaves. Sodium Toxicity level could be categorized as: sensitive (ESP < 15), semi-tolerant (ESP 15–40) and tolerant (ESP > 40). Lettuce plant considered as semi – tolerant plant.
- In this regard, most of the irrigation water sample both in the beginning and end of experiment were lower than 1 ppm. Moreover, the boron tolerance of lettuce is fall between 2 to 4 ppm. Therefore, it could be assume that irrigation water used in this study have no potential of boron toxicity

Lettuce on Hydroponic

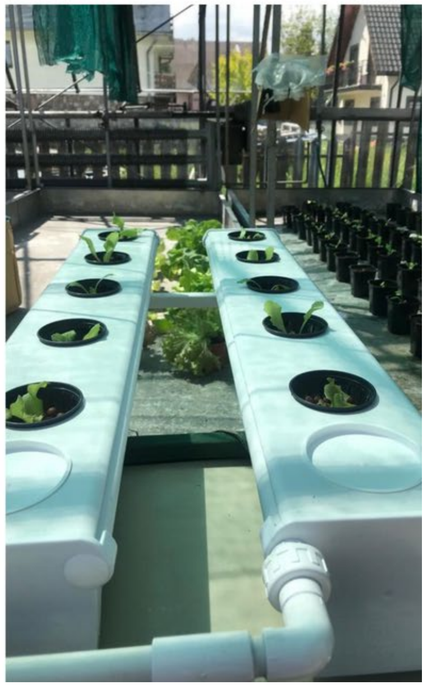
Mix of 100% Treated Geothermal Water With Nutrients





Mix of 90% Treated Geothermal Water + 10% Raw GW + Nutrients

Mix of 70% Treated Geothermal Water + 30% Tap Water + Nutrients



Mix of 100% Treated Geothermal Water With Nutrients

Mix of 90% Treated Geothermal Water + 10% Raw GW + Nutrients

Mix of 70% Treated Geothermal Water + 30% Tap Water + Nutrients

Lettuce on Soil Cultivation

First Week of Experiment

Third Week of Experiment

Fifth Week of Experiment

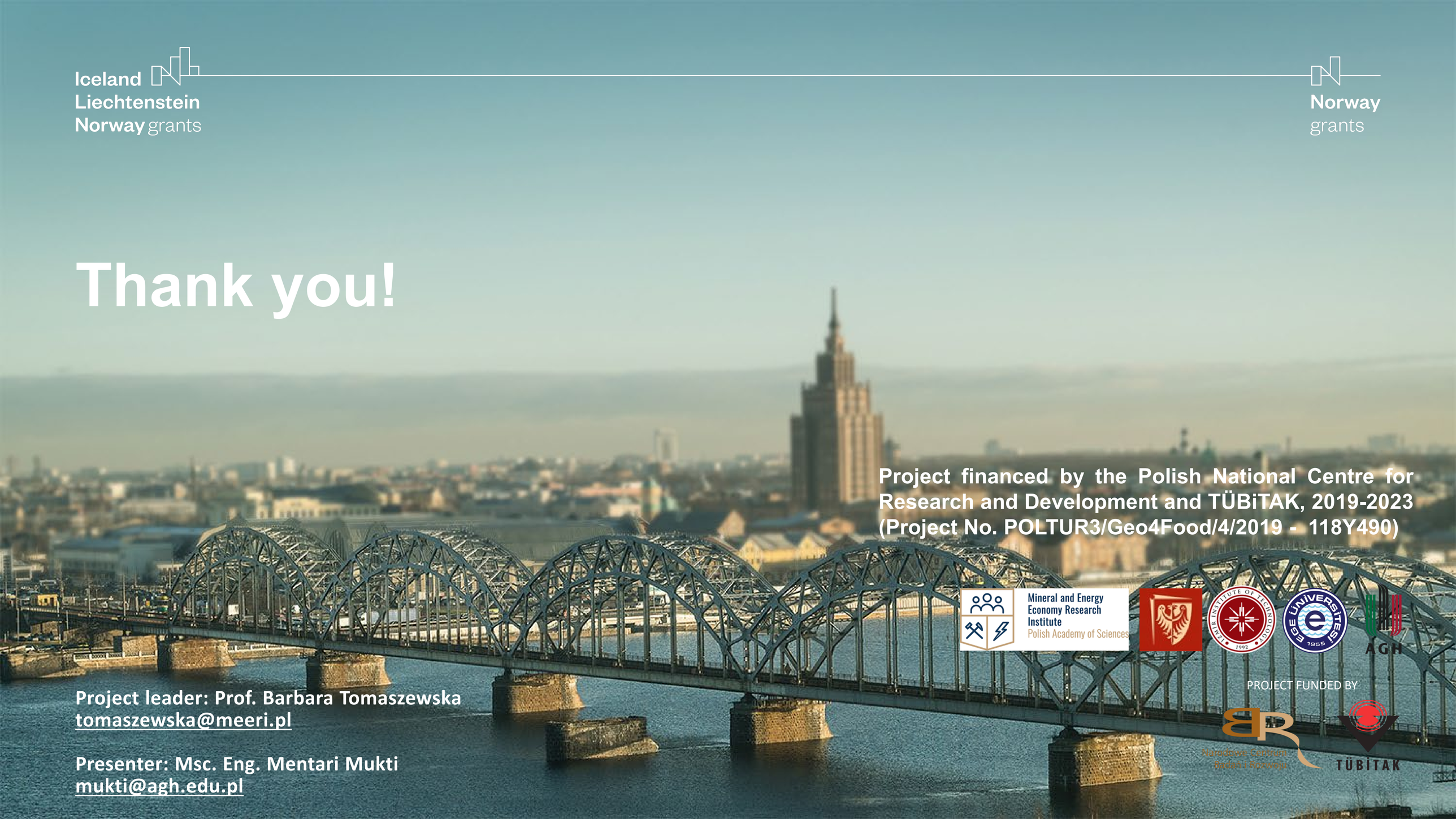
Mix of 100% Treated Geothermal Water With Nutrients

Mix of 90% Treated Geothermal Water + 10% Raw GW + Nutrients

Mix of 70% Treated Geothermal Water + 30% Tap Water + Nutrients

Conclusions

- The experiment on lettuce cultivation using treated geothermal water both in soil and hydroponic system in Poland was success.
- The physical parameter such as air temperature, air humidity, EC and pH were measured and controlled to make sure that the plant was growth in the optimum conditions.
- Irrigation water quality produced from geothermal water treatment was classified as Class 1 (70% TGW + 30% Tap Water & 100% TGW), Class II (90% TGW + 10% Raw GW)
- The chemical properties on lettuce leaves will be analyzed in the future, together with the bioavailability of micro and macro nutrients on lettuces.



Thank you!

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