

# Toxicity of copper in plants

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## Background

Copper is used in many ways as an antibacterial material. <sup>1)</sup>

Ex : Doorknob, Water Pipe



When plant roots have copper ions, they have a negative effect on plant growth.

From the latest study...

Some people think silver ions can be inactivated by Sodium Chloride.



We think copper ions have the same result.

< Experiment 1 > To check the effect of toxicity of copper in plants.

### Material

- Radish(Seed)
- Spinach(Seed)
- Pure Water
- Copper Sulfate solution ( 2 %)
- Copper Nitrate solution ( 2 %)

### Method

- We took 10ml of each Pure Water, Copper Sulfate, Copper Nitrate in separate petri dishes.
- We put the Radish and Spinach seeds in different petri dishes for every solution.
- We covered them with aluminum foil to protect them from the sun.
- We observed them for two weeks.

### Result

- When we used Copper Sulfate and Copper Nitrate →No plant growth.
- When we used Pure Water→We saw the plant growth.

### Discussion

- Copper Sulfate and Copper Nitrate prevented the plant growth.
- Radish plant growth was more than Spinach plant, because we think that Nitrogen available in Copper Nitrate has a positive effect on the plant growth.
- We used Radish and Copper Sulfate in experiment 2.



Figure1 Growth after two weeks (Left: Spinach Right: Radish)

< Experiment2> To check the Sodium Chloride effect on Copper Sulfate.

### Material

- Radish(Seed)
- Sodium Chloride solution (30,40,50,60,80,100mmol)
- Pure Water
- Copper Sulfate solution ( $5.0 \times 10^{-4}\%$ ,  $5.0 \times 10^{-5}\%$ )

### Method

- We took 10ml of each Pure Water and Copper Sulfate in separate petri dishes.
- We added 30,40,50,60,80,100mmol Sodium Chloride solution in Copper Sulfate solution.
- We covered them with aluminum foil to protect from the sun.
- We observed them for 1 week.

### Result & Discussion

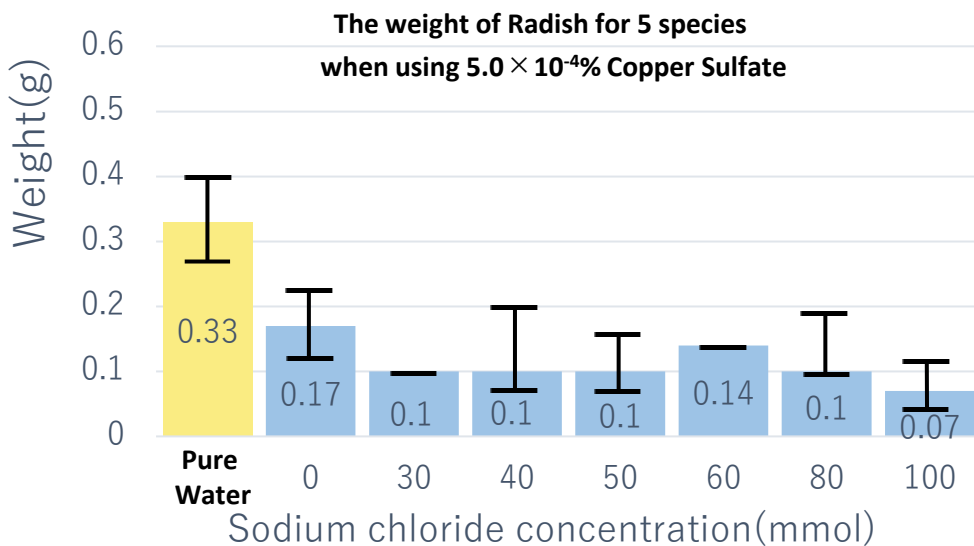


Figure 2

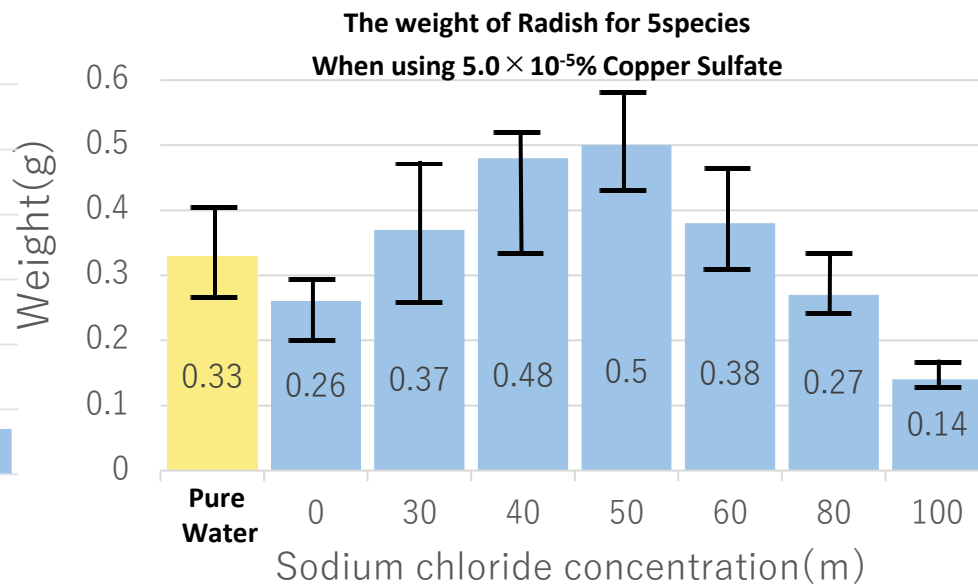


Figure 3

- When using Copper Sulfate ( $5.0 \times 10^{-4}\%$ )
  - the plant didn't grow well → Sodium chloride effect was too great.

- When using Copper Sulfate ( $5.0 \times 10^{-5}\%$ )
  - Heavier than others when using 40mmol,50mmol Sodium Chloride.
  - Leaves are yellow and roots are thick.
  - The concentration of Sodium Chloride and Copper Sulfate that plants can grow and work ions on the roots.

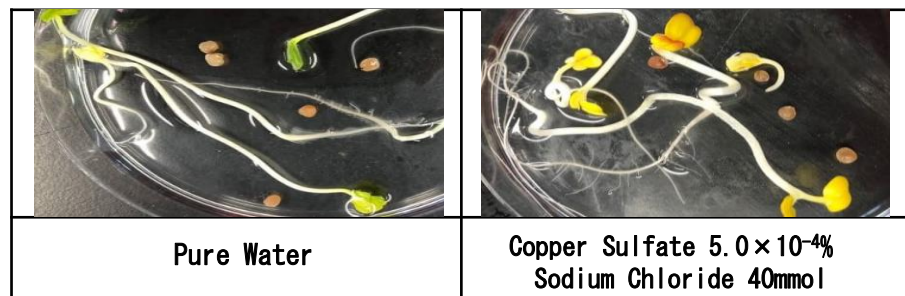


Figure 4 Plant growth

## Conclusion

- From Experiment1and Experiment2,We think
  - Sodium chloride has the effect to prevent the toxicity of copper in plants.
  - Sodium chloride and copper sulfate solution have the most suitable concentration combination.

## Futurework

- We want to check
  - the concentration of Sodium Chloride and Copper Sulfate in which plants can grow more easily.
  - the role of the plant growth.
  - the regularity of results.

## References

- 岸田直裕 他, 銅を用いた水中の微生物の不活化技術の現状と課題 日本公衛誌 第60巻第9号(2013)
- 松村吉信, 銀イオンや銅イオンの抗菌性—作用メカニズムと微生物適応戦略 科学と教育53巻5号(2005)