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Improving the fertility of mine tailings with the use of compost materials

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Outline

- Introduction ⟶ The problem
- Methodology ⟶ Study area
- Results
- Conclusions

Introduction → The problem

- Cyprus´ mining activity had been focusing on copper and sulfide ores significant copper and production center.
- Notably, Cyprus has hosted various mines because of its rich and heterogeneous geology, which were then abandoned.
- Lack of legislation Consequences affecting the environment:
  - extremely low pH levels
  - high concentration of heavy metals
  - lack of organic matter.

  } ~~Mine tailings~~
- Best techniques for remediation of soil from heavy metals:
  - the usage of plant species being a means of remediation (e.g. phytoremediation)
  - soil conditioners appliance (e.g. compost).

Methodology → Study area

- Our target → Improve the fertility of mine tailings with the use of compost materials.
- For this reason, the experimental research was held in the abandoned Northern mine in Mathiatis.
- 2 species were investigated: *Medicago sativa* and *Pinus brutia*.

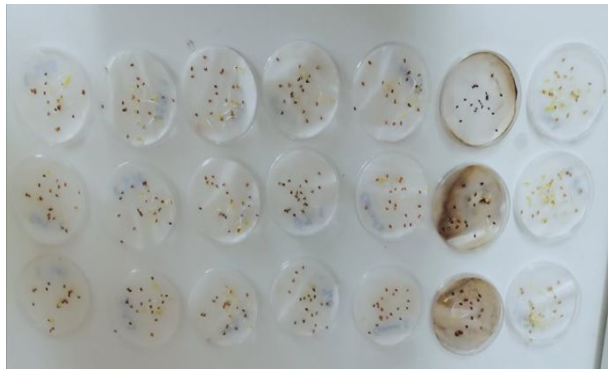
Picture 1: North Mathiatis Mine

Picture 2: Mine tailings

Methodology → Study area

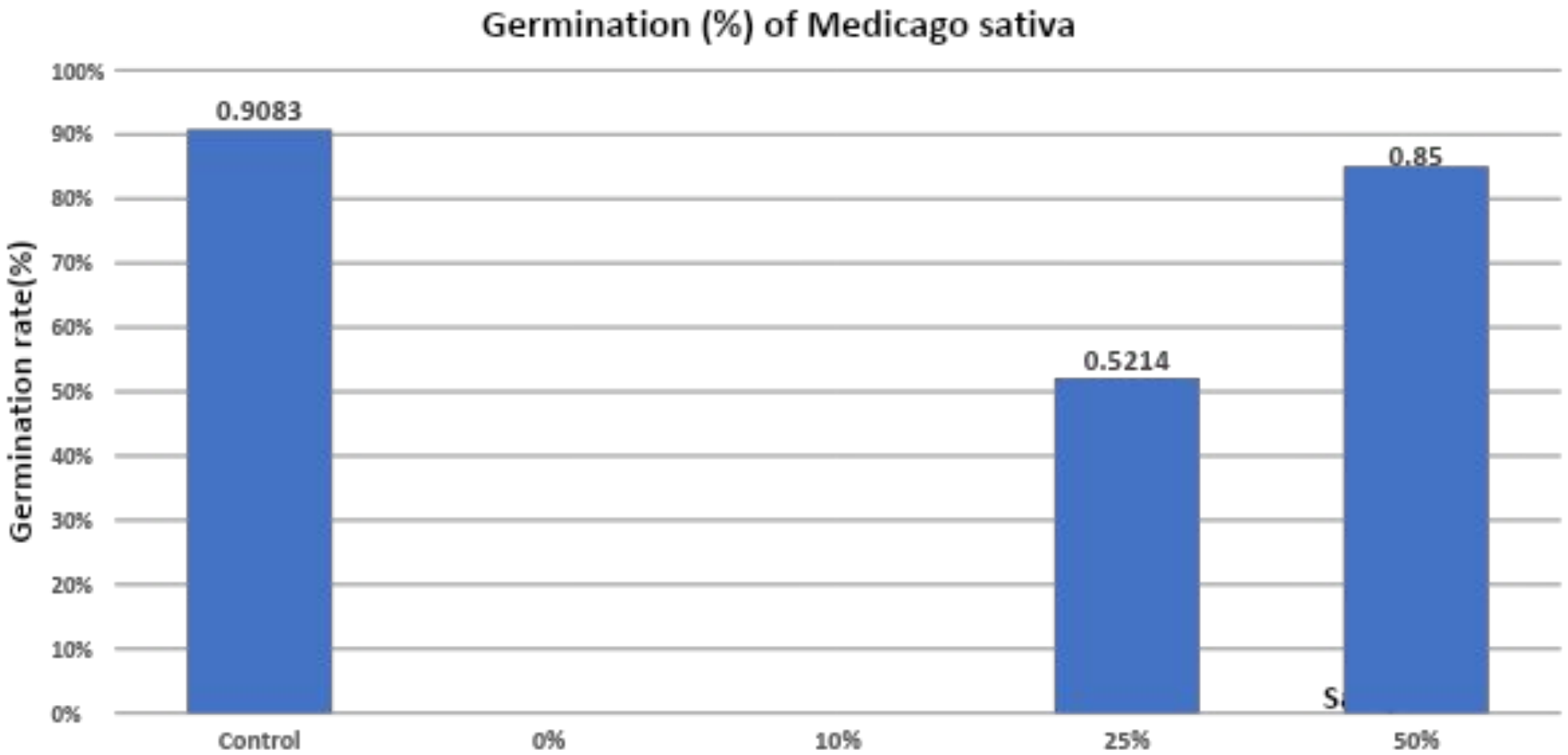
- For the accomplishment of the experiment, an experiment in pots within a greenhouse has been made, under controlled conditions.
- Firstly, field sampling was completed in order to collect soil samples form piles waste from the abandoned mine in Mathiatis.
- Then it was mixed with compost with proportions of 0%, 10%, 25% and 50%.
- *Medicago sativa* seeds and *Pinus brutia* plants were then plant, so as to evaluate the effectiveness of compost disposal in mine tailings.
- Laboratory experiments performed:
  I. Soil water holding capacity (SWHC)
  II. Plant biomass
  III. Soil respiration
  IV. pH and EC
  V. Phytotoxicity test

Picture 3: Pots with Medicago sativa



Picture 4: Phytotoxicity test

Results


Germination (%) of Medicago sativa
Germination rate(%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.9083
0.5214
0.85
Control
0%
10%
25%
50%

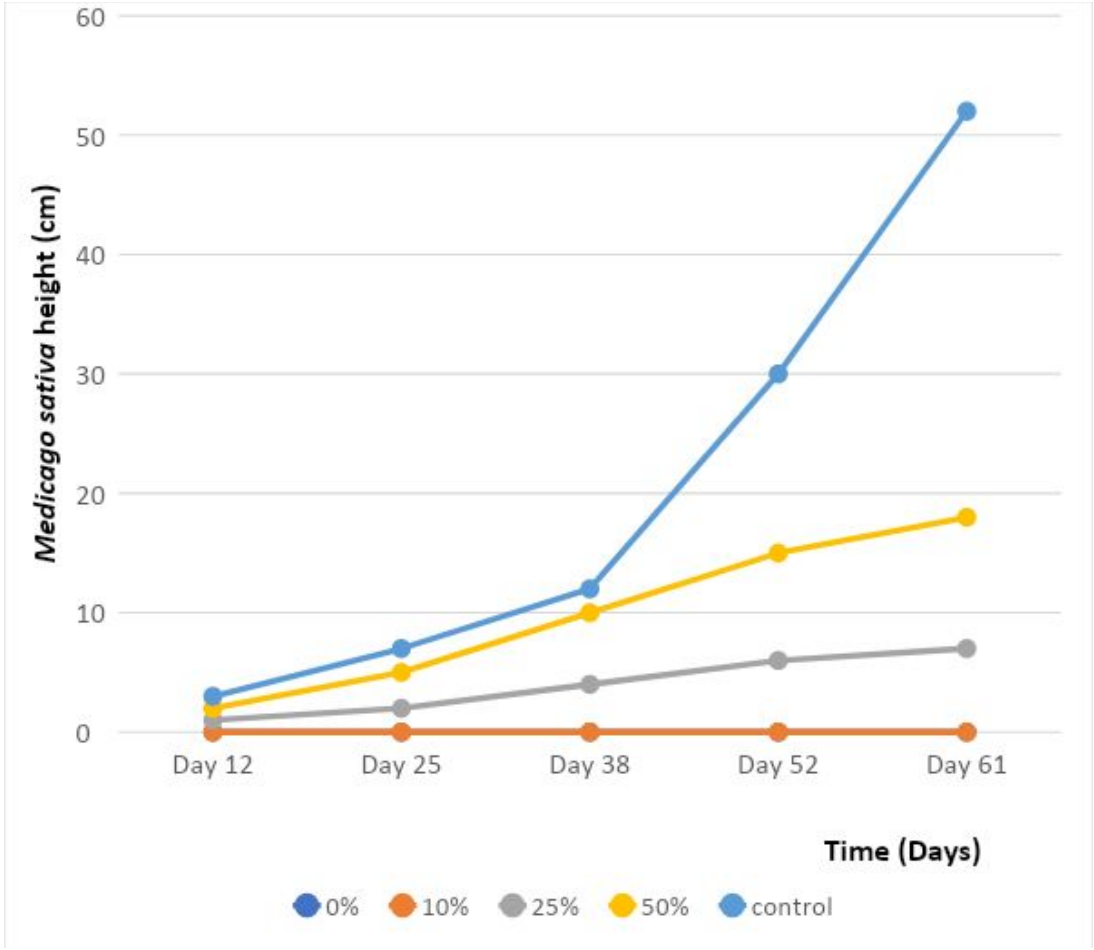
Number of Medicago sativa seeds germinated and Percentage of Germination Success

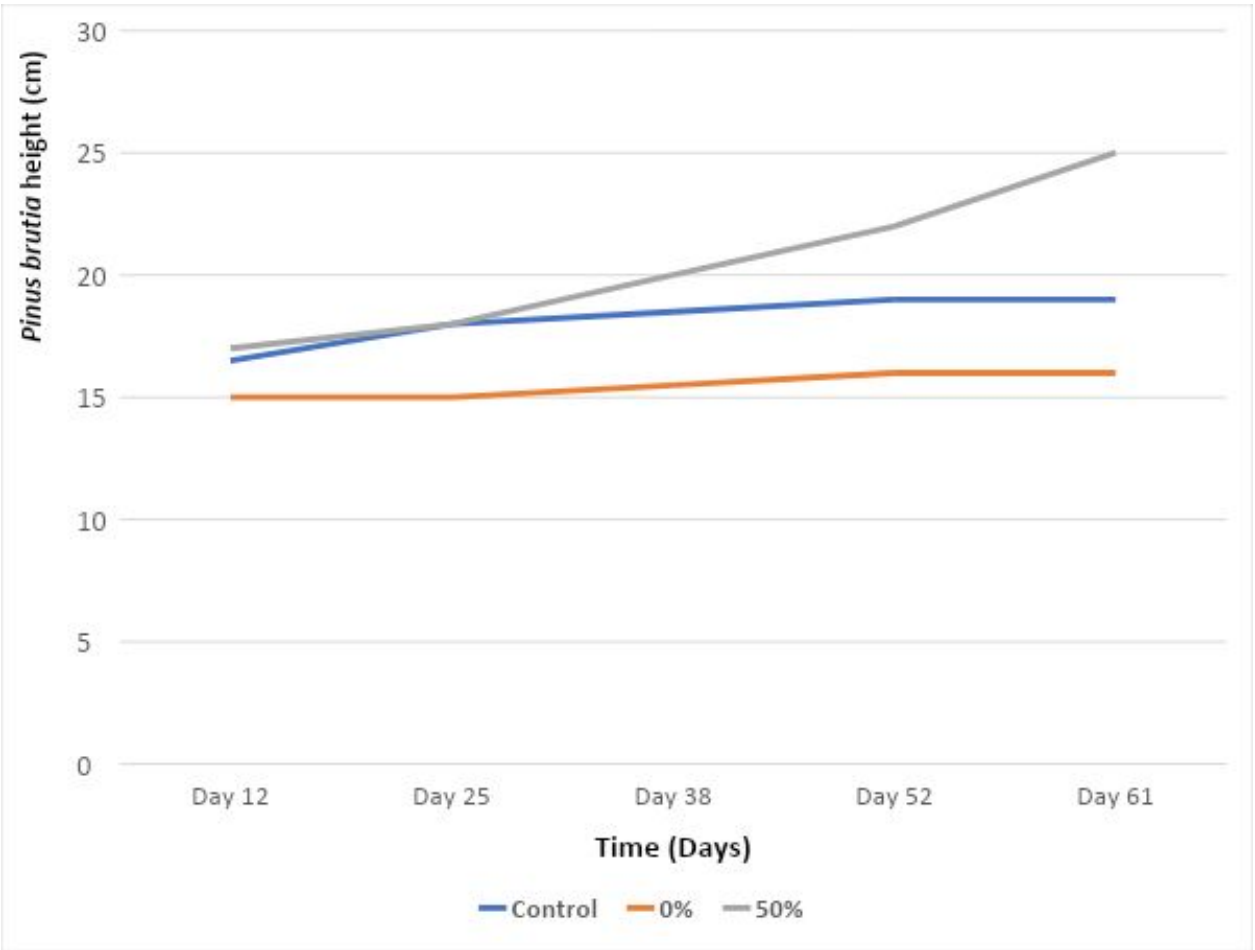
	Pot										
	1	2	3	4	5	6	7	8	9	10	Germination Rate (%)
Control	19*	20	18	20	12	20					90.83%
0%	0	0	0	0	0	0	0	0			0%
10%	0	0	0	0	0	0					0%
25%	4	10	11	16	14	16	2				52.14%
50%	16	20	17	17	15	20	17	16	18	16	85%

■ : *No pot*

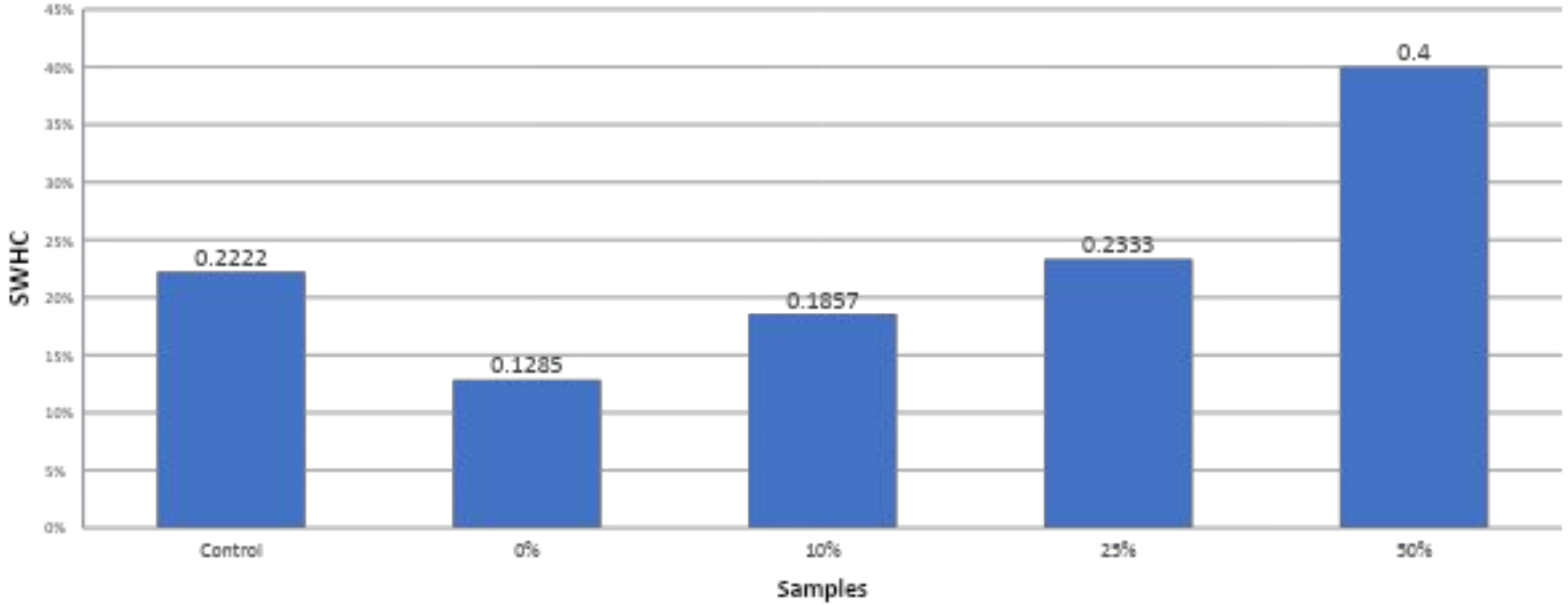
**Number of seeds germinated from 20 per pot*

Medicago sativa & *Pinus brutia* height

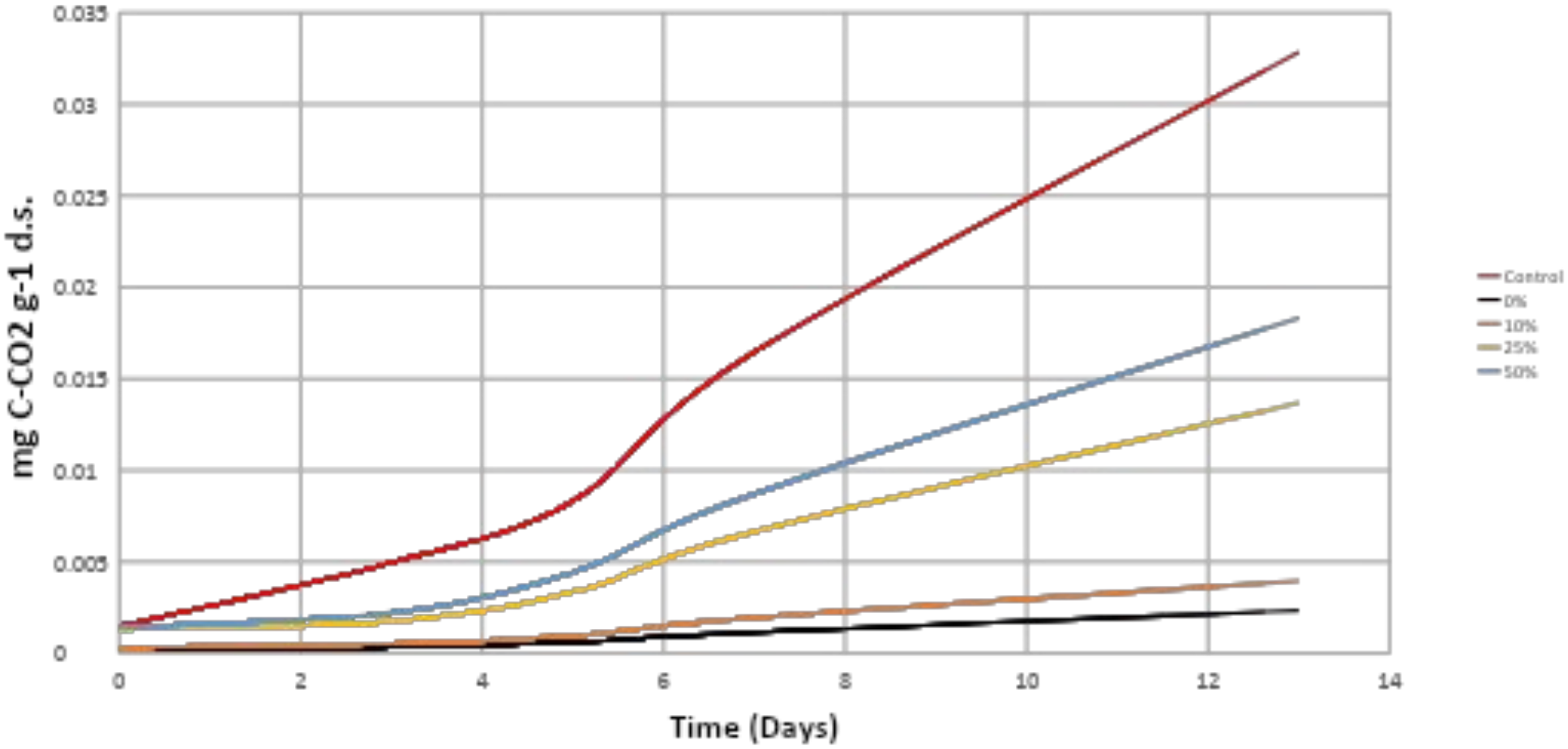




Soil Water Holding Capacity (SWHC)



Soil Respiration

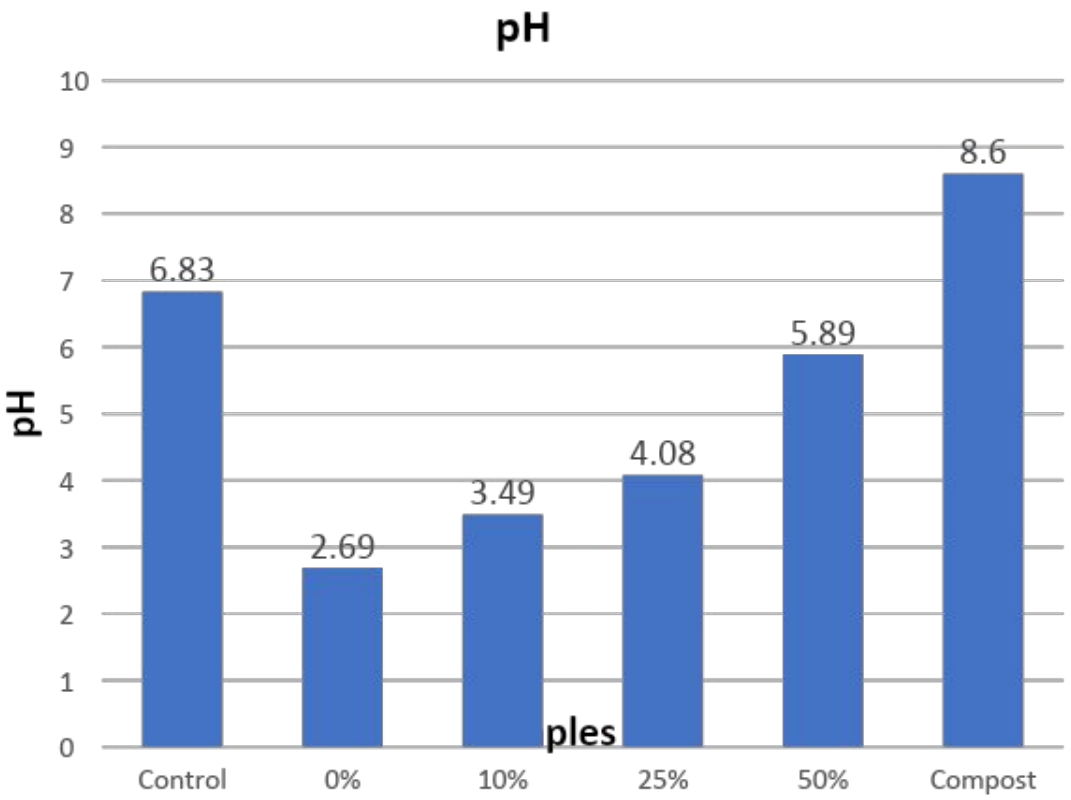


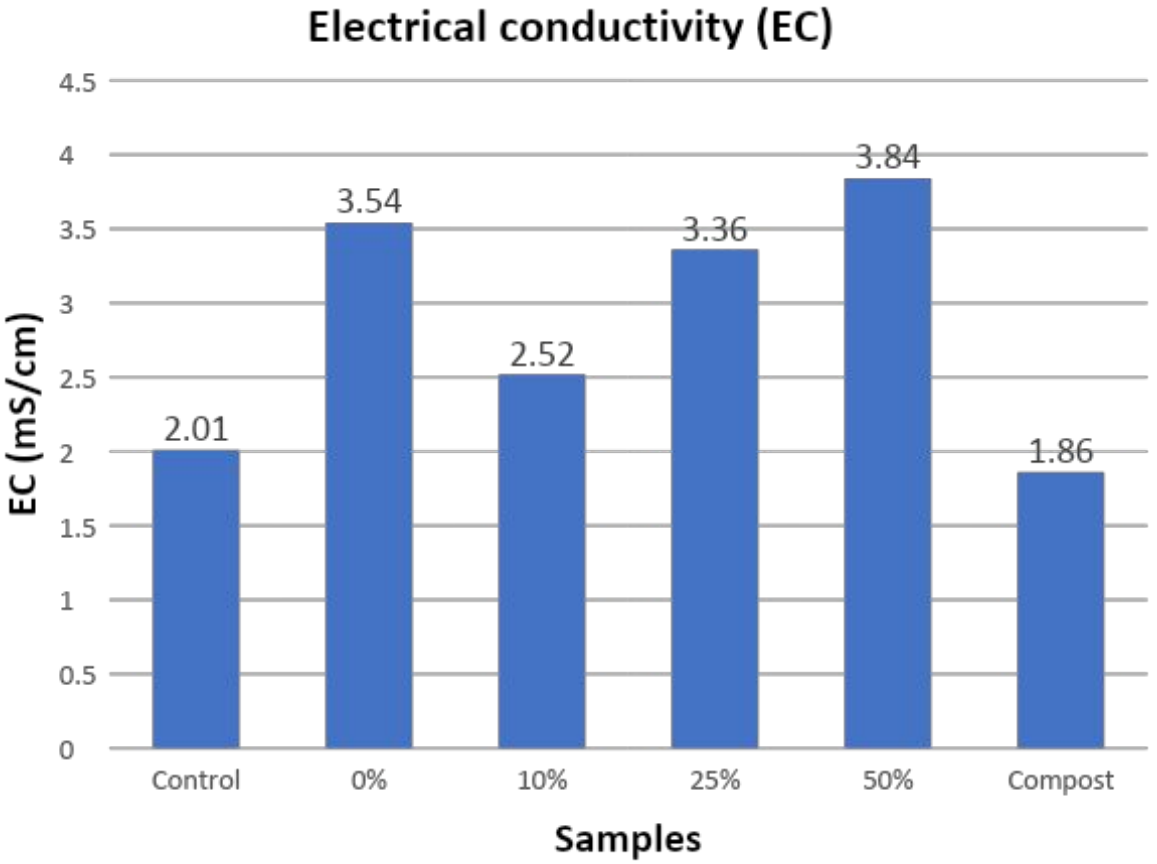
Medicago sativa biomass

Samples	Average of plant biomass
Control	22.47
50%	22.06
25%	20.23

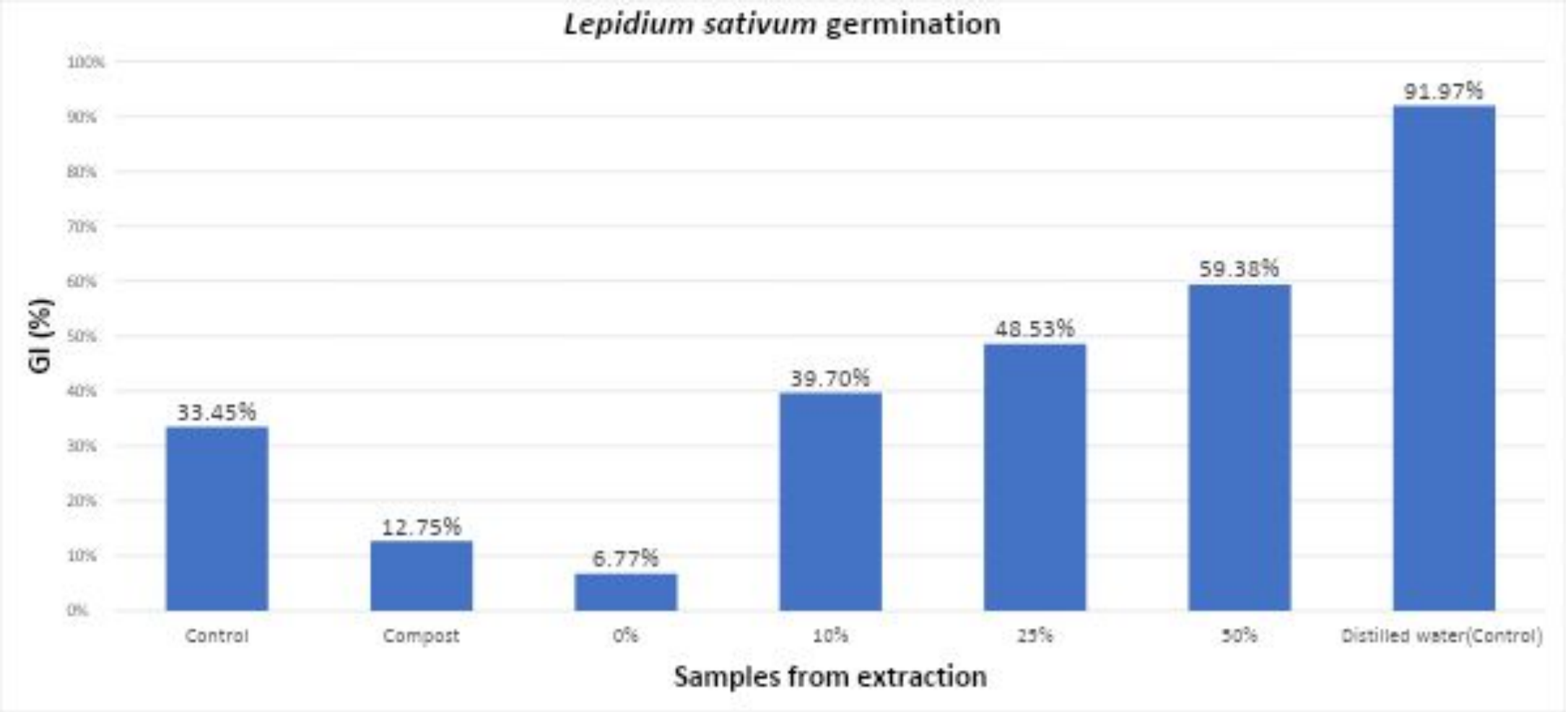
Picture 4: *Medicago sativa* in pots

pH & EC


pH
10
9
8
7
6
5
4
3
2
1
0
pH
6.83
2.69
3.49
4.08
5.89
8.6
Control
0%
10%
25%
50%
Compost
ples


Electrical conductivity (EC)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
EC (mS/cm)
2.01
3.54
2.52
3.36
3.84
1.86
Control
0%
10%
25%
50%
Compost
Samples

Phytotoxicity test



Discussion

- The germination rate of *Medicago sativa* seeds increased the most within tailings samples of 50% compost at 85%.
- The addition of compost as a source of organic matter significantly increased the soil water holding capacity (SWHC), plant biomass and soil respiration.
- The acidic pH of the tailings showed a noticeable increase and also the percentage of germination index (GI) showed that the addition of compost is able to reduce the effect of phytotoxicity.
- The application of compost in tailings showed a significant positive correlation with the increase in the height of *Pinus brutia* plants, since in the samples with 50% compost the height of the plants increased ~10cm.

Conclusion

- Effective remediation of mining waste can be achieved by adding soil conditioners such as compost.
- Therefore, the use of *Medicago sativa*, *Pinus brutia* and the application of compost could be efficient in the ecological restoration of the tailings in the abandoned North Mathiatis mine as well as other mines with the same environmental conditions.

Thank you for your attention!

Any Questions?