Phytoremediation Potential of Industrial Hemp for Heavy Metal Contaminated Abandoned Mine Land Soil in Hazleton, PA

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Introduction

In recent years, **phytoremediation** has emerged as a promising strategy for mitigating heavy metal contamination on soils, leveraging the natural capabilities of plants to sequester and detoxify pollutants. Hemp (*Cannabis sativa* L.) has garnered attention for its potential in this field due to its **rapid growth, deep root system, and tolerance to various environmental stressors** [1]. Among other reparative plant varieties, industrial hemp stands out for its robustness and capacity to **accumulate heavy metals** from contaminated soils [1].

This poster explores the phytoremediation potential of industrial hemp in the context of abandoned mine land soils in Hazleton, PA, where persistent heavy metal pollutants pose **significant environmental and health risks** [2].

Through a review of relevant literature and experimental findings, the efficacy of industrial hemp in **detoxifying specific heavy metals** will be assessed, highlighting its role as a sustainable solution for **rehabilitating** degraded landscapes and promoting ecosystem resilience.

Fig. 1: Abandoned Mine Land in Hazleton, PA

Methods

The **research methods** employed in this study involve the following steps:

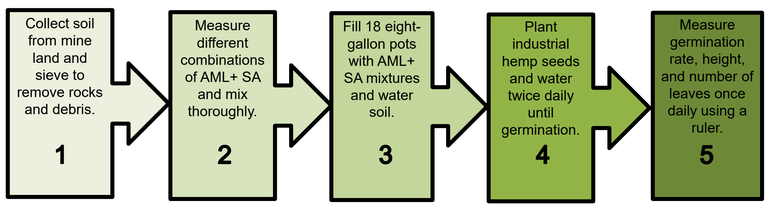
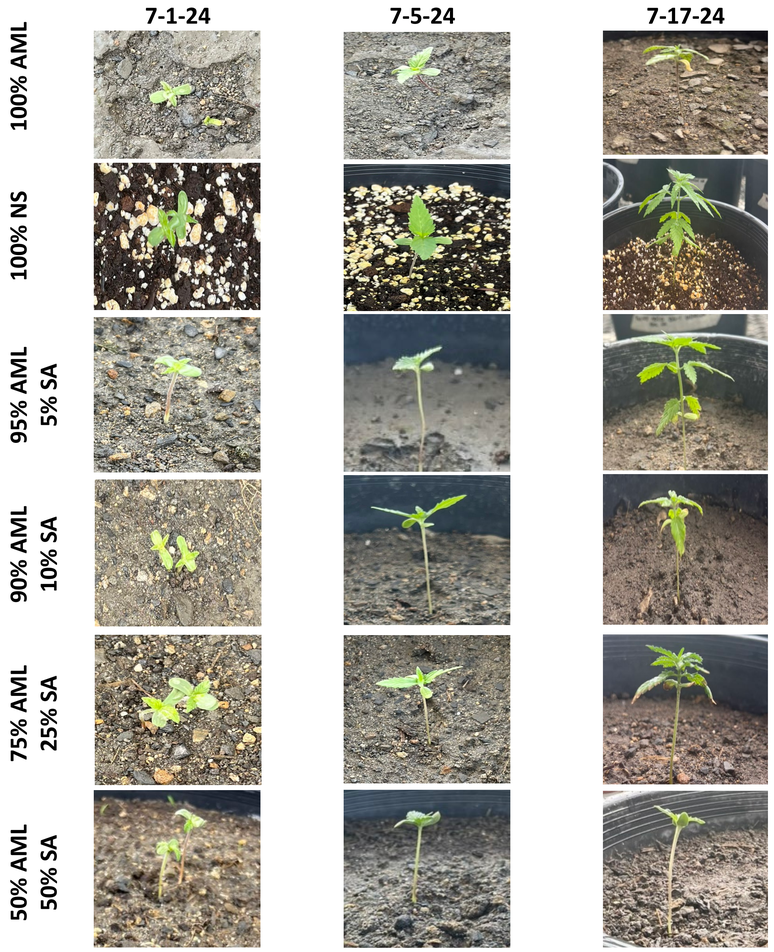


Table 1: Different Soil Combinations of Abandoned Mine Land (AML) Soil and Soil Amendment (SA)

Pot #	Soil Composition	Total Mass of Soil (g)	Mass of Soil Ingredients (g)
1, 2, & 3	AML	8,000	8,000
4, 5, & 6	NS	8,000	8,000
7, 8, & 9	95% AML + 5% SA	8,000	7,600 AML + 400 SA
10, 11, & 12	90% AML + 10% SA	8,000	7,200 AML + 800 SA
13, 14, & 15	75% AML + 25% SA	8,000	6,000 AML + 2,000 SA
16,17, & 18	50% AML + 50% SA	8,000	4,000 AML + 4,000 SA

Results

Fig. 2: Macroscopic Changes in Hemp Development in 6 Soil Compositions Over 16 Days



95%AML/5% SA showed the **most** robust growth compared to the 100% AML control. **All** soil compositions showed **greater shoot length, leaf count, and vitality** when compared to 100% AML control except for **50% AML/50% SA.**

Citations: [1] Rheay, H. T., Omondi, E. C., & Brewer, C. E. (2021). Potential of hemp (Cannabis sativa L.) for paired phytoremediation and bioenergy production. *GCB Bioenergy, 13*(4), 525-536. https://doi.org/10.1111/gcbb.12782 **[2]** Candeias, C., Melo, R., Avila, P. F., Ferreira da Silva, E., Salgueiro, A. R., & Teixeira, J. P. (2013). Heavy metal pollution in mine-soil-plant system in S. Francisco de Assis Panasqueira mine (Portugal). Applied Geochemistry, 44, 12-26. https://doi.org/10.1016/j.apgeochem.2013.07.009

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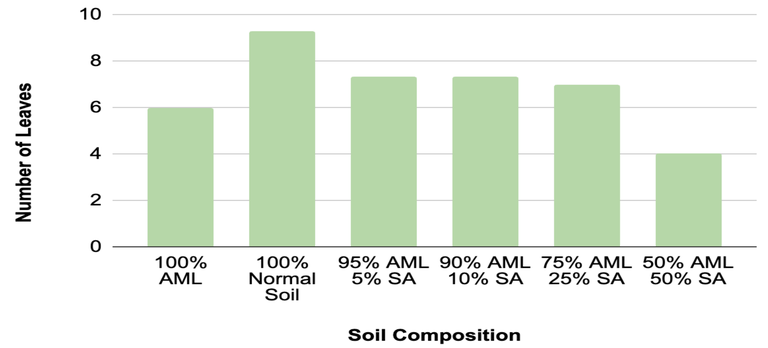
Leaf Data Analysis

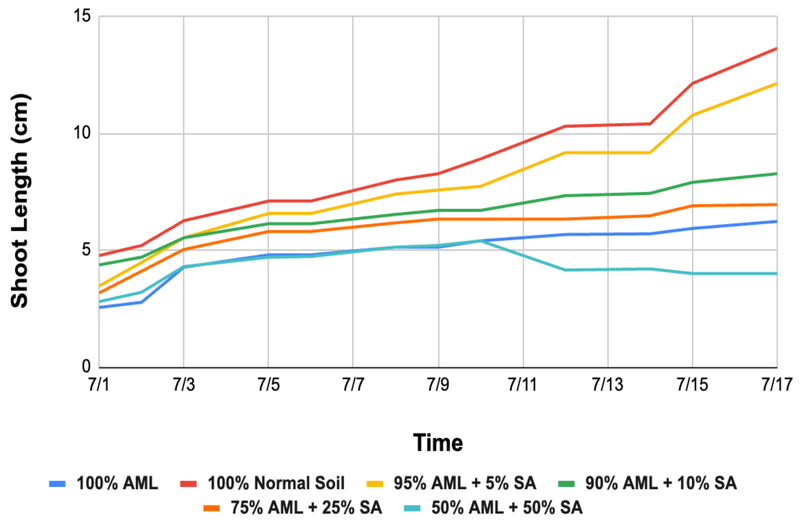
Figure 4: Average Number of Leaves on 7-17-24



Compared to normal soil, **95% AML/5% SA** and **90% AML/10% SA** resulted in the **highest leaf yield** which correlates with the steady **growth** in **shoot length** over time.

Discussion

Fig. 3: Changes in Average Shoot Lengths Over 16 Days



All soil compositions showed **growth** over time **except for** 50% AML/50% SA. **95% AML/5% SA showed the most growth** compared to the normal soil control.

Conclusions & Future Research

- **Positive correlation** between industrial hemp growth and small amounts of soil amendment indicate a hopeful future for a **cost-effective** solution to abandoned mine land remediation
- Ongoing data collection will include **root and soil analysis** which will give insight into industrial hemp's ability to detox heavy metals from abandoned mine land soil

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