Phytoremediation of *Camelina*, Switchgrass, and *Miscanthus* In Abandoned Mine Land Soils of PA

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- Remediate abandoned mine lands in Pennsylvania through phytoremediation.
- Determining which variety of biofuel crop out of *Miscanthus senensis*, Switchgrass, and *Camelina sativa* would grow best on marginal soil.



Abandoned Mine land (AMl)

- Un-managed area of land
- Threats to human health and the environment
 - Sulfur
 - Aluminum
 - Iron
 - Cadmium
- Soil becomes marginal







Phytoremediation

Uses living plants to remove contaminants in the soil

- Cost effective
- Ability to remove various containments
- More efficient alternative than ٠ engineering procedures of soil extraction





Camelina sativa

- Native to Europe and Central Asia
- 30-40% oil by seed weight
- Omega 3 oil
- Cold and drought tolerant
- Requires little water or nitrogen to flourish
- Non-food crop





Switchgrass

- Native to North America
- Perennial
- Low-input crop
- Ethanol production
- Adaptable
- Can grow under a wide range of climate and soil conditions
- Non-food crop





Miscanthus senenisis

- Native to regions of Africa and Southern Asia
- Rhizomatous biofuel crop
- Rapid growth
- Massive ethanol production
- Non-food crop





Methods and Materials



- Marginal soil samples (5 gallon buckets) were collected from three different abandoned mine land locations.
- Soil was mixed and screened.
- Sampled soil from 3 different locations were filled in three pots from each location; the fourth was the control.





Methods and Materials Cont'd







- Both plant's seeds were then planted into the soil.
- Miscanthus was planted through vegetative production and cut to 7.2 cm.
- Each plant was then placed into the green house to begin germination



Methods and Materials Cont'd

• Each plant was watered with 200 ml of water to be vigilant of overwatering.



- Progression and watering was recorded and managed every two days. Pictures were also taken weekly.
- As time progressed, the amount of water was increased between either 250-500 ml depending on the moisture levels.
- After seven weeks, each plant was trimmed and sent to an outside lab for tissue culture analysis as well as soil.







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Results Cont'd





Summary

• Marginal land can be reclaimed through utilization of cost effective biofuel crops.

- •Not all of the crops were as suitable for metal uptake:
 - Camelina was the slightest
 - Least suitable for phytoremediation
 - Slowest growth rate (32.5cm)
 - Switchgrass was the medium
 - Potential for phytoremediation
 - Medium growth rate (45.7cm)
 - Miscanthus was the greatest
 - Most suitable for phytoremediation

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- Best growth rate (116cm)



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Future Study

- This study will be continued beyond these 10 weeks.
 - Additional soil and tissue analysis' will be taken.
- Analysis can be done on the other forty-six different varieties of Camelina
- Statistical analysis can be done through additional plant tissue analysis of the three crop samples.



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