Biochar as a Carbon Banding Alternative

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Image 1: Carbon band applied over seed furrow in Corvallis, Oregon on 25 April 2023.

INTRODUCTION

Establishment of perennial grass seed fields often use carbon banding that overlays the seed furrow with activated charcoal approximately 2.54 cm in width, followed by a preemergent herbicide application to the entire field. The carbon band absorbs the herbicide and acts as a safener for the germinating grass seed in the seed furrow. While this technique is effective, alternatives to activated charcoal may provide options that are more economical. Biochar is a carbon-rich soil amendment derived through pyrolysis of organic residues. Some biochars have physicochemical characteristic similar to activated charcoal and a previous greenhouse experiment suggested that biochar may be an option for carbon-banding (Trippe et al., 2020). Because some biochar is produced in the Pacific Northwest, this local source of biochar may provide a more economical option in Oregon.

OBJECTIVE

Compare a mixed-conifer source biochar to a standard activated charcoal as a carbon-banding option to assess whether there is a difference in crop safety among six pre-emergent herbicides.

EXPERIMENTAL DESIGN

A randomized complete split plot design experiment replicated four times was implemented on 20 October 2022 at the Oregon State University Hyslop Field Lab in Corvallis, Oregon and repeated on 25 April 2023.

Whole plot factors included three carbon sources:

1. **Activated Charcoal**
2. **Mixed-Conifer Source Biochar**
3. **No Carbon**

Sub-plots included preemergent herbicides applied at the following rates:

1. **Diuron (2.692 kg a.i. ha^{-1})**
2. **EPTC (4.908 kg a.i. ha^{-1})**
3. **Indaziflam (0.015 kg a.i. ha^{-1})**
4. **Pronamide (0.289 kg a.i. ha^{-1})**
5. **Pyroxasulfone (0.045 kg a.i. ha^{-1}) + Flumioxazin (0.035 kg a.i. ha^{-1})**
6. **Rimsulfuron (0.053 kg a.i. ha^{-1})**
7. **No Herbicide Control**

Carbon sources were mixed in a slurry comprising of 2.3 kg of product in 37.9 liters of water applied at a rate of 28.0 kg of carbon source per hectare. Carbon was applied directly above the furrow using fixed spray nozzles attached behind the seeder. 'Prominent' perennial ryegrass was sown at a rate of 13.2 kg of seed per hectare on a 30.5 cm row spacing. Preemergent herbicide applications were applied after seeding using a CO_2 pressurized backpack sprayer with a handheld boom comprising of four TeeJet XR11001VS flat spray nozzles. The carrier volume was 187 liters per hectare with a boom pressure of 2.1 bars. In the October initiated experiment, no irrigation was applied because rain was forecasted for the following five days (rainfall from October 22nd to October 26th totaled 2.24 cm). In the experiment initiated in April, 1.27 cm of irrigation was applied over the course of 72 hours post herbicide applications. To assess crop safety, surviving perennial plants or plant density per area were assessed in both runs of the experiment.

Image 2: One block on 31 May 2023. Whole-plot treatments were (left to right): activated charcoal, no carbon, & biochar.

Image 3: Example of perennial ryegrass survival and furrow density post herbicide applications on 31 May 2023.

RESULTS

In both runs of the experiment, compared to no carbon, biochar provided a similar level of crop safety as activated charcoal when diuron, pronamide, or a combination of pyroxasulfone + flumioxazin were applied. Biochar did not improve crop safety compared to no carbon when EPTC was applied in the first run, when rimsulfuron was applied in the second run, or when indaziflam was applied in both runs of the experiment. Activated charcoal did not improve crop safety compared to no carbon when indaziflam or rimsulfuron were applied in the first run of the experiment (Figures 1 and 2).

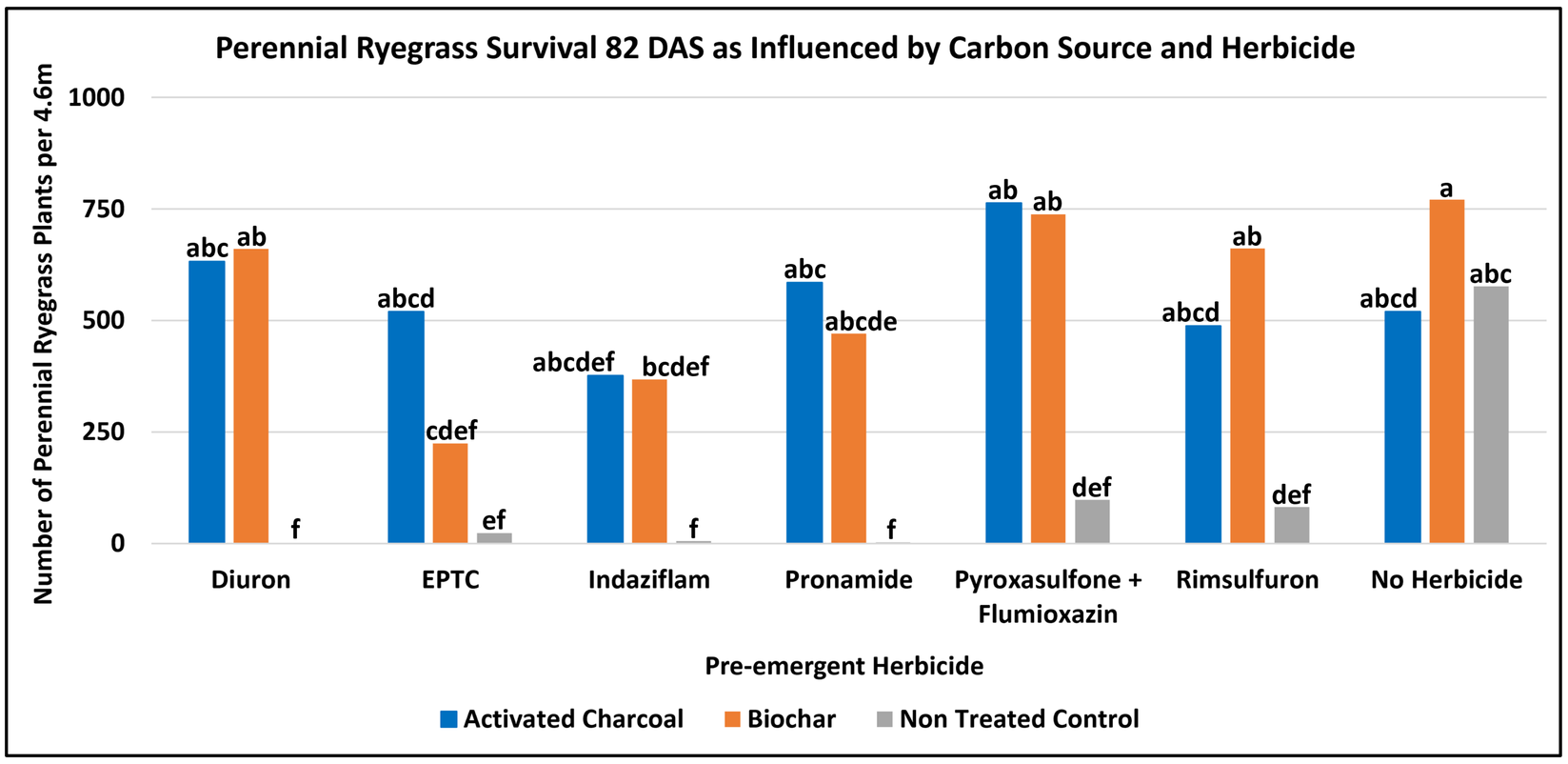

Figure 1: Perennial ryegrass survival 82 days after seeding (DAS) as influenced by carbon source and herbicide on 09 January 2023. Carbon banding and seeding occurred on 19 October 2022. Herbicides were applied on 21 October 2022. Means not sharing a letter are significantly different according to Tukey's HSD test at a 5% level of significance.

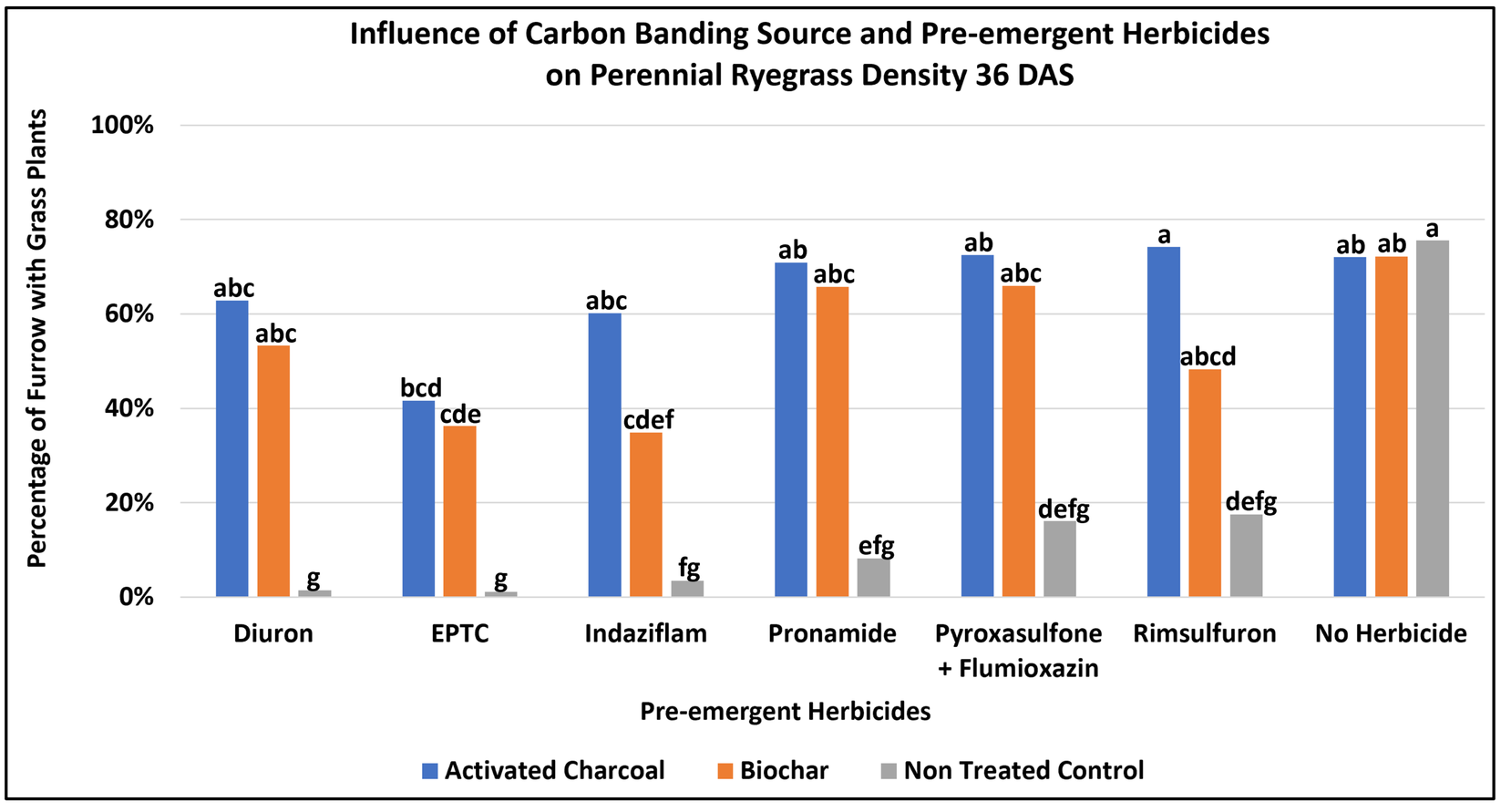

Figure 2: Perennial ryegrass density in the seed furrow 36 days after seeding (DAS) as influenced by carbon source and herbicide on 31 May 2023. Carbon banding and seeding occurred on 25 April 2023. Herbicides were applied on 28 April 2023. Means not sharing a letter are significantly different according to Tukey's HSD test at a 5% level of significance.

REFERENCES

Trippe, K.M., Meyer, K.M., Watts, D., Novak, J.M., and Garcia-Jaramillo, M. (2020). Biochar: an alternative to activated carbon in carbon seeding for the establishment of perennial ryegrass. In Anderson, N., Hulting, A., Walenta, D., and Mallory-Smith, C. (eds.) 2020 Seed Production Research Report. Ext/CrS 164.

FURTHER INFORMATION

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