An Examination of Pipeline Site-Preparation Methods for Improving Plant Establishment

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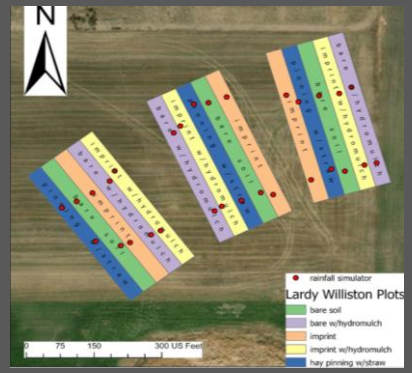
Introduction

In North Dakota and around the world, energy development has increased demand for pipelines. Repeated issues related to plant establishment, soil loss, and infiltration, may require multiple reseeding attempts. Our research tests wood-fiber hydromulch, land imprinting, and wheat-straw crimping under rainfall simulation to gauge the effectiveness of reducing water and sediment runoff.

This research aims to improve the understanding of said methods of reclamation as well as the combination of hydromulch and imprinting.

Methodology

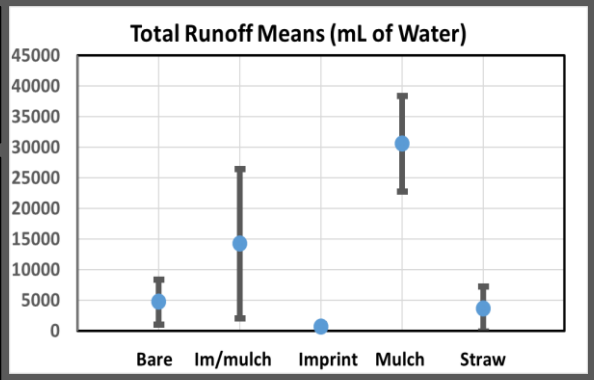
Sites at the Williston, ND REC were prepped in 3 randomized blocks (below left) with imprinting, crimping, hydromulch, the combination of hydromulch and imprinting, and no treatment as the control. All plots were seeded with oats (10 lbs/acre) and a native seed mix (38 lbs/acre) with plant establishment to be evaluated in 2021. The native seed mix contained western wheatgrass, slender wheatgrass, green needlegrass, and side-oats grama. Each treatment strip of hydromulch received 1000 gallons of water and 300 lbs of mulch. Each hay treatment received 1, 1-ton straw bale. Imprinting, which is more novel, creates V-shaped depressions on the landscape catching water, seed, and sediment. Rain simulations were conducted in Sept. 2020, for 30 min. at each plot, simulating a 25-year rain event for the region (1.39 in of rainfall). Bulk density, sediment load, and total runoff were analyzed. There were 30 plots total.

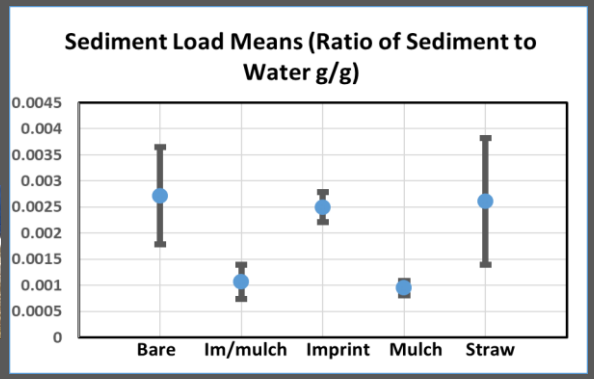


Results

Bulk density was analyzed first using a Kruskal-Wallis rank sum test. No means were statistically different, requiring no further analysis (p-value= 0.515).

Means for both sediment load and total runoff are displayed with their corresponding standard errors.
*imprint for total runoff standard errors of the mean were very small.
**imprint also had one simulation generate 0 mL of runoff.





Pictured: Hydromulch (very top), Imprint (top), Hydromulching (Right), Bare (next right), Straw-crimping (far right), Imprinter (top left), Pin meter looks at imprint changes (bottom left), Plot map (far left).

Sediment Load (Mann-Whitney U-Test)	Bare	Im/mulch	Imprint	Mulch
Im/mulch	**0.0022**	-	-	-
Imprint	1	**0.0238**	-	-
Mulch	**0.0022**	0.8182	**0.0238**	-
Straw	0.5887	**0.0043**	0.7143	**0.0022**

Total Runoff (Mann-Whitney U-Test)	Bare	Im/mulch	Imprint	Mulch
Im/mulch	0.132	-	-	-
Imprint	**0.005**	**0.0367**	-	-
Mulch	**0.0022**	**0.0411**	**0.005**	-
Straw	0.3776	0.1275	0.0898	**0.005**

* Results are significant at $p < 0.05$

Discussion

Utilizing a wood-fiber hydromulch, regardless of combination, significantly reduced sediment loads by at least 100% when compared to the other treatments. We attribute this to a "sealing" effect. It is worth noting that both treatments with hydromulch also significantly increased total runoff, due to a "sealing" effect again. Imprinting was significantly different than the control for total runoff, but not sediment load. Straw was not statistically different than the control for either variable.

References

•Babcock, D., and R. McLaughlin. 2013. Erosion control effectiveness of straw, hydromulch, and polyacrylamide in rainfall simulator. Journal of Soil and Conservation. 68(3):221-227. doi: 10.2489/jswc.68.3.221
•Dixon, R., & Carr, A. (1999). Land imprinting for restoring vegetation in the desert southwest. United States Forrest Service. Washington, D.C. Accessed at https://www.fs.fed.us/rm/pubs/rmrs_p003/rmrs_p003_325_328.pdf Verrified on 10/20/2020.
•North Dakota Geologic Survey. 2020. New Postings About the Bakken. NDGS. Bismarck, ND. https://www.dmr.nd.gov/ndgs/bakken/bakkenthree.asp

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