

Executive Summary and Implementation

Remediating Soil for Successful Vegetation Establishment along Nebraska Highways

Research Objectives

- Determine the effect of several soil remediation treatments that reduce bulk density (compaction) and sodium concentration at the soil surface on plant canopy cover, species composition, biomass, and soil physical and chemical properties;
- Compare the effect of seeding time (fall versus spring) on plant canopy cover, species composition, and biomass in response to the various soil remediation treatments; and
- Determine cost-effective remediation practices of vegetation establishment for recommendation to NDOR.

Research Benefits

This project will address the challenge of establishing acceptable vegetation cover on the compacted, sodium-affected soils of roadway shoulders.

The expected outcome of the project includes recommendation to NDOR on potential solutions for improving vegetation establishment on roadside shoulders.

Successful completion of this project will add to the knowledge base for developing solutions and improving vegetation establishment on roadsides and will benefit NDOR maintenance operations and motorist safety.

Principal Investigators

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Background

Vegetation along roadsides is important to prevent soil erosion, provide habitat, and filter water running off the road. Vegetation close to the pavement along highways in Nebraska does not readily establish and persist. It is thought that the sodium and bulk density are the driving factors behind the lack of vegetation.

Proposed Implementation by the Principal Investigator

Seven remediation methods for representative problematic sites will be evaluated. Treatments will be a combination of organic amendments, mechanical disturbance, and creating micro-environments. The HWY L80E Beaver Crossing will be used for the project because we have extensive measured soil data for various sites there. The study sites will represent the worst-case scenario in both salinity (30% salinity) and compaction (>1.8 Mg/m³) levels. The remediation treatments will be based on the hypothesis that the soil surface needs to be mechanically disturbed to 7.5 cm depth to loosen the soil surface, thus reducing the bulk density and creating a better seedbed for the seeded species.

All plots will be prepared and seeded as is done conventionally by an NDOR seeding contractor except for application of the experimental treatments. Treatments will be applied in the fall for fall seeding and in the spring for spring seeding. The different seeding times are designed to evaluate the effect of soil moisture and temperature on plant establishment. To normalize initial conditions, plots will be fertilized with low grade N-P-K fertilizer before seeding, and covered with straw mulch to keep soil conditions moist and minimize seed movement.

Soil responses that will be measured include but are not limited to electrical conductivity, Na, Ca, Mg, pH, soil organic matter, N, P, bulk density, water infiltration, penetration resistance, temperature, soil moisture, and simulated rainfall for runoff and sediment measurements at 1 month and 6 months after treatment applications.

NOTE: The HWY L80E plots were installed but destroyed; the replacement plots installed in a different Nebraska location were also lost. The PI formulated an alternative strategy in fall 2018: to analyze the relationship between soil properties and canopy cover on paved and unpaved shoulders in the Panhandle, south central, and southeast regions of Nebraska.

Conclusion

The purpose of the study was to determine if sodium and bulk density are the driving factors of vegetation cover. Soil properties and vegetation cover were examined in relation to shoulder type (paved or not paved) and time since seeding. The study was conducted by collecting soil samples and identifying vegetation cover from 53 sites in three different regions, the Panhandle, Southcentral and Southeast regions, in Nebraska, USA. The soil was analyzed for pH, electrical conductivity, sodium chloride and bulk density. At each site vegetation was designated into one of four categories, bare ground (>70%), annual vegetation (>70%), perennial vegetation (>50%), and bare ground-annual vegetation mix (~50-50%). We found that sodium and bulk density had little effect on the establishment and persistence of vegetation. Shoulder type and time since seeding showed limited effect on the soil variables measured. The researchers suggested that post seeding events and disturbances may be contributing to the lack of vegetation along highways.

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Quote

The analysis “showed that no soil variable measured or combination of measured variables explained the type of vegetation cover found at the sampled sites.” By PI and Co. PI

Recommendations for Implementation

Results from this study conflict with results from the Phase 1 research. Methods used in Phase 1 controlled more variation compared to the subject study (alternative sampling methods had to be developed midway through the study). NDOT will refer to this study’s results when local information is needed on particular highway roadsides.

Interested in finding out more?

Final report is available at:
[NDOT Research Website](#)

**This brief summarizes Project SPR-1(18) M079
“Remediating Soil for Successful Vegetation Establishment Along Nebraska Highways”
Nebraska Department of Transportation Research Program**