University of Texas Rio Grande Valley: Soil Infiltration

Texas-Coahuila-Tamaulipas-Nuevo Leon Regional Workgroup

KEY PROJECT HIGHLIGHTS:

- UTRGV Project demonstrated the benefits of tillage and compost for improvement of vegetation establishment to reduce runoff and increase soil infiltration.
- Project served as an on-hand, learning tool for UTRGV students on agricultural practices

Urban development in the US-Mexico border region has led to an increase in impervious surfaces and soil compaction. Soils and substratum in the region contain an appreciable amount of expansive clay, which is prone to surface crusting and sealing. This change increases stormwater runoff and the chances of urban flooding. The wash-off of pollutants by runoff may also create sediment and water quality problems for receiving waters. To alleviate these problems, infiltration practices such as rain gardens and bioswales have been adopted in the region. Reducing runoff and increasing infiltration is highly desirable in semi-arid region such as Lower Rio Grande Valley.

The University of Texas Rio Grande Valley received Border 2020 Program funds of approximately $49,600 USD, with an additional leverage amount close to $40,000 USD. The project focused on remediating urban compacted soils to improve infiltration by adopting agronomic practices (tillage and compost). Tillage is a common practice used in agricultural lands to loosen and mix the topsoil while compost amendment can reduce bulk density and improve infiltration capacity of the soil. In this project, tillage and compost amendment are hypothesized to provide the greatest benefits in remediating compacted soils, meeting the ultimate goals of reducing runoff, increasing infiltration (and thereby groundwater recharge), and improving vegetation establishment.

The objective of this project was to evaluate an urban soil remediation method consisting of tillage and/or compost amendment in a field-testing site (0.13 acre) located at the UTRGV Edinburg campus. Specific tasks were three-fold:

- Establish a field-testing site for evaluating soil remediation methods;
- Determine infiltration rate, bulk density, penetration resistance, and runoff water quality;
- Determine a turfgrass health indicator.

The site selected represented a typical urban soil that has been graded and compacted by construction activities (Fig. 1).

Figure 1. Site setup and turfgrass establishment. (Top Left to Right: Initial Site, Tillage, 1-month after hydroseeding; Bottom Left to Right: Compost, Hydroseed, 4-month after hydroseeding)

The site received 4 different land treatments: 1) tillage only, 2) compost only, 3) tillage + compost, and 4) no tillage + no compost (Fig. 2).

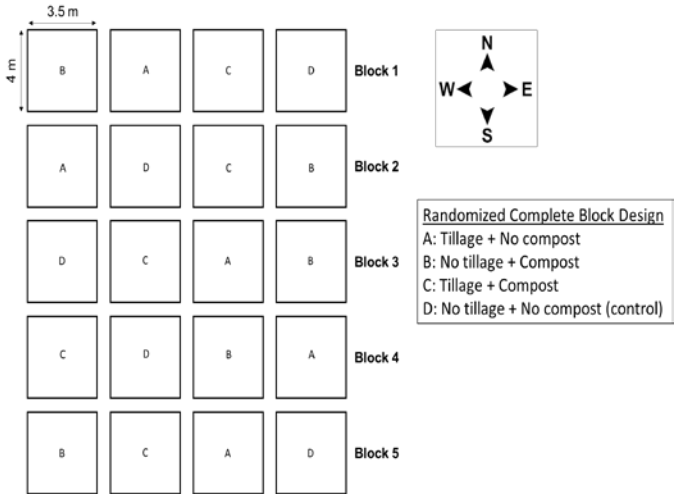

Figure 2. Randomized Complete Block Design for compost and tillage treatments.

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After the land treatments, common Bermuda grass was hydroseeded and in-ground irrigation was operated for the first two months for the vegetation establishment. The project team measured key soil physical properties over time (infiltration rate, bulk density, and penetration resistance) along with in-situ runoff experiments and turf health to evaluate the treatment effects on remediating urban compacted soils.

The project outcomes from the field-testing site were the following:

- Tillage was effective in reducing soil compaction (bulk density and penetration resistance), but tilled soils were reconsolidated during 21 months of monitoring period.
- Compost amendment demonstrated its benefit for better turf appearance (think, dark green) and improved infiltration rate.
- Both tillage and compost were effective for promoting turfgrass growth and soil physical health. If tillage is not applicable, just adding compost would help.
- The longevity of tillage treatment is somewhat questionable as bulk density tended to increase over time. As a conventional lawn management, core aeration would be desirable to minimize soil compaction (e.g., once a year).
- Applying compost and tillage did not pose any nutrient loss concern in runoff water. It is important to note that tilled and/or compost-amended plots has uneven surface compared to control plots.

The project team presented their results at various conferences and meetings. These included: 1) an oral presentation at the 2019 Soil Science Society of America Annual Meeting; 2) 2019 Rio Grande Valley Water Quality Management & Planning Conference; 3) 2019 Border 2020 Gulf Task Force public meeting. In addition to the field testing used as the project site, it also served as outdoor classroom for UTRGV students in environmental science, geology and soil science courses (Figure 3 and Figure 4).

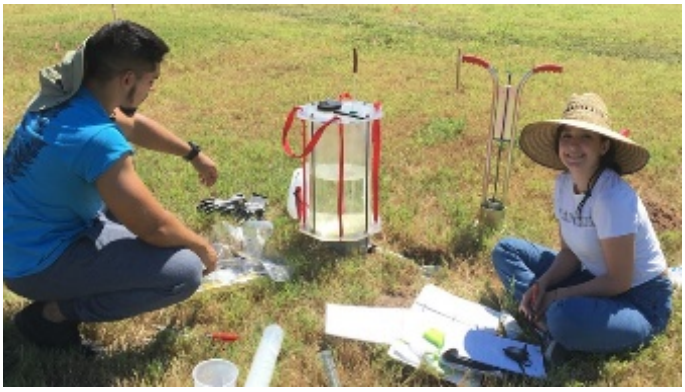

Figure 3. UTRGV students conducting experiments as part of classroom hands on exercises on project site.

Figure 4. UTRGV students conducting experiments as part of classroom hands on exercises on project site.