Potential of Pasture Grasses to Reduce Soil Runoff in Simulated Spring Seeding Applications

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INTRODUCTION

- Sediment runoff has long been established as a major concern and contributor to declines in surface water quality in the Midwestern United States over the past several decades.
- One contributor to sediment runoff is pasture land. As when overstocked, these systems may become overgrazed and compacted – which can increase sediment erosion and nutrient runoff resulting in issues for surface water quality [1; 2; 3].
- Best Management Practices for land usage support maintaining a dense vegetative stand to reduce sediment losses and prevent nutrient runoff [4] pasture land dedicated to grazing by livestock such as cattle, horses and small ruminants is needed.
- Compounding this need, weather pattern changes in Ohio over the past ~30 years have included "a significant increase in the number of extreme precipitation events" of rain 5 cm or more [5].
- Issues with pasture land management compounded with increasingly mercurial rainfall patterns over time signal a need for additional research into maintenance of proper pasture in the face of increased runoff potential.
- In an effort to assist in providing best recommendations to producers, the following study was developed to evaluate the soil anchoring potentials of a newly established pasture.
- Cool- and warm-season cultivars (CS and WS respectively) were selected due to the suitability of CS cultivars to thrive in Northwestern Ohio and the potential production benefits that WS cultivars offer during the the summer when productivity of CS cultivars is reduced.

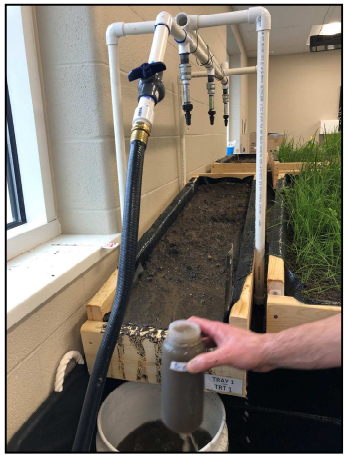

Figure 1. Runoff sample collection from replicate of "Bare Soil Dirt" treatment.

Figure 2. Rainfall simulation conducted on replicate of the "CSWS" treatment.

Table 1. Forage biomass values at rainfall simulation date.

Treatment	Vegetative Cover				Plants Per 66.5 cm²	As Fed Biomass Per 66.5 cm² (g)
	CS Grass %	WS Grass %	Weed %	Bare Soil %		
Bare Soil	0%	0%	7%	93%	0.1	0.0
CS	80%	0%	0%	20%	9.1	3.8
CSWS	47%	20%	13%	20%	7.7	2.5

METHODS

- A complete randomized design was utilized to evaluate three distinct treatments, each replicated three times. Treatments consisted of bare soil "Bare Soil", commercial mix of cool-season perennial pasture forages "CS", and a mixture of the cool-season perennial forage mix with the warm-season annual Red River Crabgrass "CSWS" each planted in a separate tray in climate controlled laboratory settings.
- Trays measured 30 cm wide x 130 cm long x 15 cm deep (~volume of 0.06 m^3) and were constructed using lumber and lined with a waterproof pond liner and were set on a 6 degree slope during rainfall simulations.
- Seeding rates accounted for germination rate and CS and CSWS treatments were seeded for equivalent expected live plants. Trays were watered throughout the study and supplemental light was provided for ~12 hours per day. Vegetation was maintained at a height of ~15 cm and fertilizer split into two applications was applied at rates of 14.7 kg/ha nitrogen, 2.4 kg/ha potassium, 1.2 kg/ha sulfur, and 0.1 kg/ha iron.
- On day 60, a 5 cm heavy spring rain was simulated by pumping a set volume of 19 L of water through 3 equally spaced spray nozzles fixed ~ 1 meter above the soil surface over a consistent period of 20 minutes. *Figures 1 and 2.*
- Subsamples of collected runoff were evaluated for total suspended solids (TSS) as a measure of sediment erosion. Vegetative cover across the pasture tray as well as number of plants and above ground biomass from a 66.5 cm^2 circle were collected at the time of the rainfall simulation.

RESULTS

- Vegetative cover, plant number, and biomass were greatest for the CS treatment, followed by CSWS and Bare Soil treatments.
- TSS analyses indicated that CS trays had least concentrated and variable runoff rates (Fig. 3) - representing a 93% reduction in TSS concentration from Bare Soil and a 69% reduction from the CSWS treatments (ANOVA: df 2, F 5.36, $p<0.05$).
- Total runoff volume for the CS and CSWS treatments were similar and about 8% less than for Bare Soil treatments.
- TSS values were not significantly different between 2.5 cm and 5 cm rainfall simulations ($T = 0.99$, $P = 0.35$)

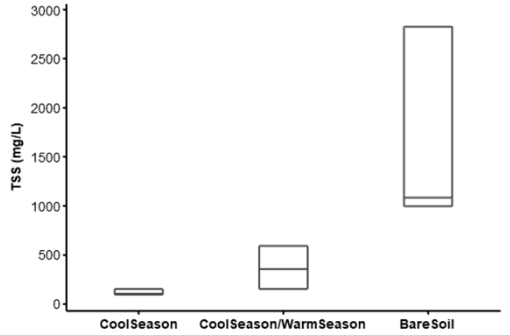

Figure 3. Total suspended solids (mg/L) following 5 cm simulated rainfall.

CONCLUSIONS

- Analyses indicate that early season establishment of cool-season grasses are optimal for reducing runoff concentrations.
- Additional mixtures may provide benefits later in growing season as summer months transition from spring.
- Pasture establishment can provide benefits for both livestock grazing opportunities as well as water quality improvements.
- Additional research into species and summer timing is needed.

REFERENCES

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