



Effects of Dredged Materials on Growth of Prairie Species

Allison M. Morgan, V.A. Borowicz

School of Biological Sciences, Illinois State University, Normal, IL 61790-4120, USA

ABSTRACT

Dredged materials are taken from Illinois waterways by the hundreds of thousands of cubic yards each year. These materials make up a composition that varies by the location of dredging but invariably contain sand and clay brought up from the bottom of rivers and lakes. These materials are amassed at three locations throughout the state. While there is wide speculation for beneficial uses, dredged materials do not currently have any definitive use. We tested the hypothesis that dredged materials could be a useful component of constructed soil by measuring the height of native prairie plants grown in one of five soil mixes in a greenhouse experiment.

Plants of four species native to Illinois prairies were grown individually in a soil mix ranging from 0 to two-thirds dredged material for 8 weeks. These consisted of three herbaceous dicots and one grass- each having 5 replicates. Height measurements were taken when planted, and three additional times including when harvested. Shoots were harvested, dried and weighed. Soil type significantly affected growth of three of the four species with growth peaking in mixes that included small proportions of dredged material. We conclude that dredged sand and silt can be useful components of soil for the four prairie species studied.

INTRODUCTION

Dredging is the removal of silt and other materials from the bottom of a body of water. Runoff and erosion of stream banks and fields clog rivers with sediment (sand/silt/clay). These are dredged from rivers and deposited at off river locations. In Illinois, dredged materials are taken at a rate of 300 thousand cubic yards per year. While it is necessary to clear the rivers of this debris, clear uses for the dredged materials remain to be found. There are current operations within the state to add sands and sediments back into soil as a native addition.

To quantify the optimal composition of soils containing silt and sand we measured shoot height of prairie species native to Illinois. We predicted that treatments at both extremes of silt and sand addition (0% silt + sand // 67% silt + sand) would grow more poorly than those with a more balanced composition (33% silt + sand).

TABLE 1. Percent Composition per Treatment

Component	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5
Horticulture Garden Soil	0.67	0.44	0.33	0.22	0
Sand + Silt Mix (1:1)	0	0.22	0.33	0.44	0.67
Composted Manure	0.33	0.33	0.33	0.33	0.33

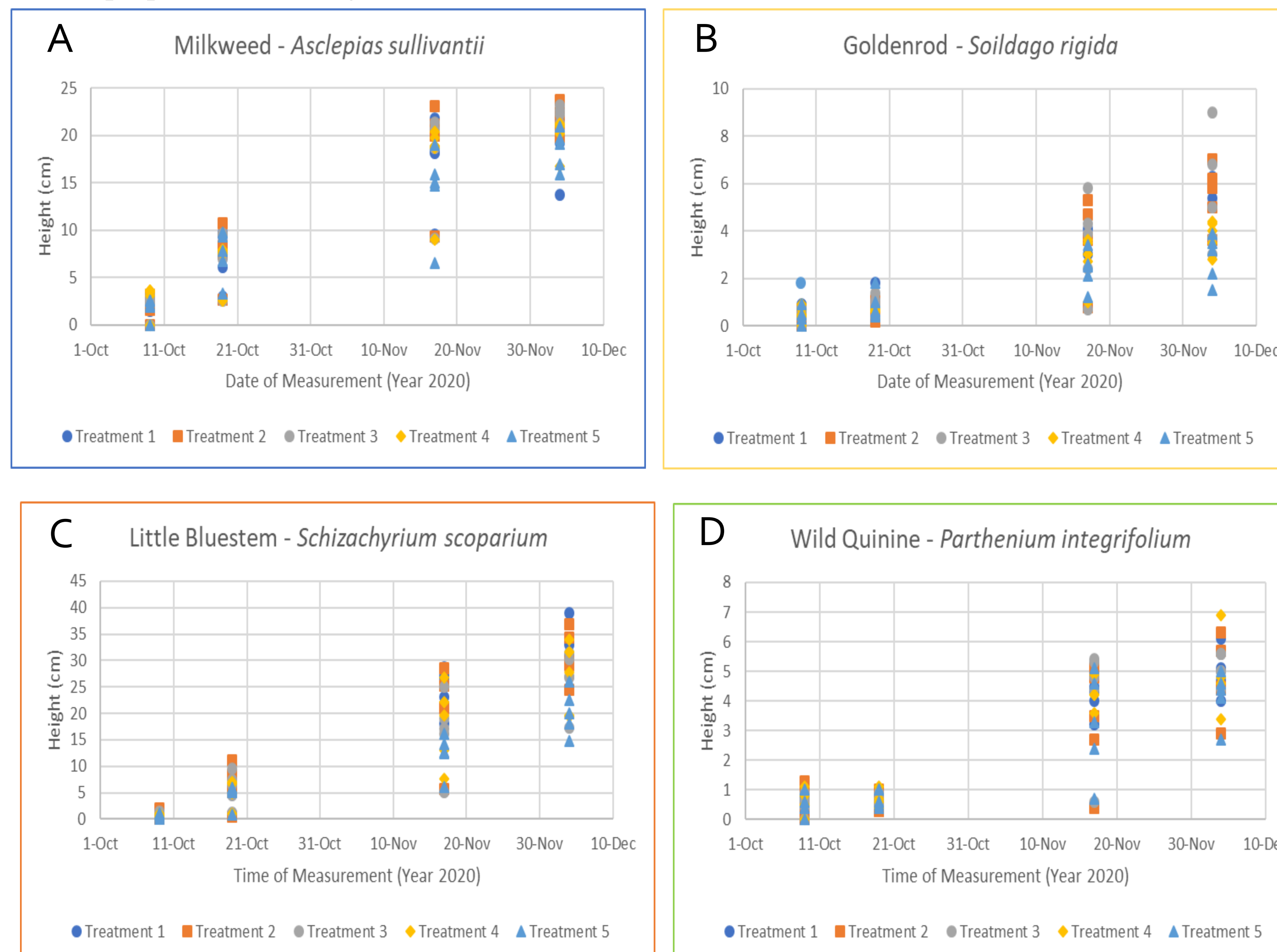


Figure 1. Better Earth Compost provided dredged materials in raw form (sand and silt).



Figure 2. Little Bluestem - *S. scoparium* growth by treatment type.

Figure 3. Height of four prairie species growing in constructed soil containing different proportions of dredged sand and silt.



METHODOLOGY

Soil: The composition of five soil treatment types is shown in Table 1. The dredged material was a 1:1 silt + sand mix from river terminal dredging provided by Better Earth Compost, Peoria, Illinois (Figure 1).

Planting: *Parthenium integrifolium*, *Schizachyrium scoparium*, *Asclepias sullivantii*, *Solidago rigida* were grown individually in 350 ml cups. Each species had 5 replicates per treatment for a total of 100 experimental plants.

Growth Conditions: Plants were watered every other day and grown for approximately 8 weeks from early October to early December in greenhouse conditions. All species were exposed to natural light, and artificial lighting that increased day duration (Figure 2.)

Measurements and Data Collection: Plant height was measured on the day they were planted (*A. sullivantii* on 10/5/2020. *P. integrifolium*, *S. scoparium*, *S. rigida* on 10/9/2020), and thrice more (10/19, 11/17, 12/4/2020).

RESULTS

Growth trends appeared at the third and fourth measurements (11/17 and 12/4/2020). *A. sullivantii* and *S. rigida* peak growth from 22% and 33% concentration of dredged materials in soil. *S. scoparium* had peak growth at 0% and 22% dredged material. *P. integrifolium* showed no obvious trends. Each species was analyzed separately. **Soil treatment significantly affected growth** of the grass *S. scoparium* ($F_{4,20} = 11.43$, $P < 0.0001$), the goldenrod *S. rigida* ($F_{4,20} = 3.79$, $P = 0.0188$), and the milkweed *A. sullivantii* ($F_{4,20} = 3.66$, $P = 0.0214$). The trend was for **greater growth** with **22% of the soil consisting of dredged material** however this level did not differ from no addition. For these three species a high proportion of dredged material (67%) yielded significantly poorer growth (Fig. 3 A-D).

CONCLUSION

Dredged materials for these four prairie species was a useful component of soil, especially in concentrations of about 22%. Concentrations of sand and silt in this range can be recommended for plant growth. This research provides new information about plant growth in dredged materials and may offer guidance to those within Illinois making constructed soils. Examples for uses include **prairie remediation**, **erosion stoppage**, or **home garden planting**.