BENCH VEGETATION FOR A TWO-STAGE DITCH

ANDI HODAJ, GRADUATE RESEARCH ASSISTANT
DEPARTMENT OF AGRICULTURAL AND BIOLOGICAL ENGINEERING
PURDUE UNIVERSITY

Importance of bench vegetation

The vegetation on the benches

- helps protect these benches from erosion,
- reduces the velocities of the water which allows for more interaction time between flowing water and the soil-plant system on the benches, for potential nutrient uptake from the system.
- should be carefully selected

Purpose of the experiment

Determine if there is a certain plant/mix of plants that performs better on the benches of two-stage ditches and that can be recommended for extensive use. Performance is measured by:

- Establishment ability
- Nutrient uptake
- Impact on bank stability

Plant selection criteria

- Plant mixes already in use:

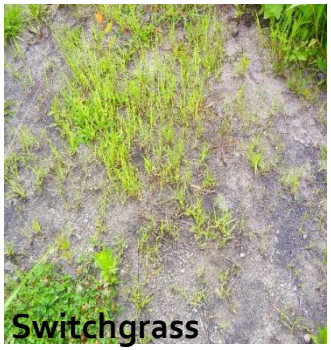
1. NRCS buffer strip mix,
2. Spence Nursery (Muncie, Indiana) two-stage mix

- Additional plant mixes that:
  - establish well and include warm and cool season plants
  - have large water consumption
  - are resistant to invasive species
  - have a high ratio above/below ground biomass

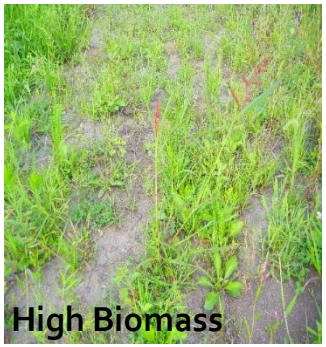
Plant mixes selected

1. Buffer strip mix
   - tall fescue, orchard grass, perennial rye grass, virginia wildrye
2. Switchgrass monoculture
3. Spence nursery two-stage bench mix
   - frank's sedge, fox sedge, riverbank wild rye, virginia wild rye, switchgrass, prairie cordgrass
4. High biomass mix
   - virginia wildrye, switchgrass, big bluestem, cup plant, swamp rose mallow, wild senna
5. Nutrient retention mix
   - switchgrass, big bluestem, cup plant, field oval sedge, meadow sedge, prairie rosinweed, greater straw sedge


Buffer strip


Switchgrass

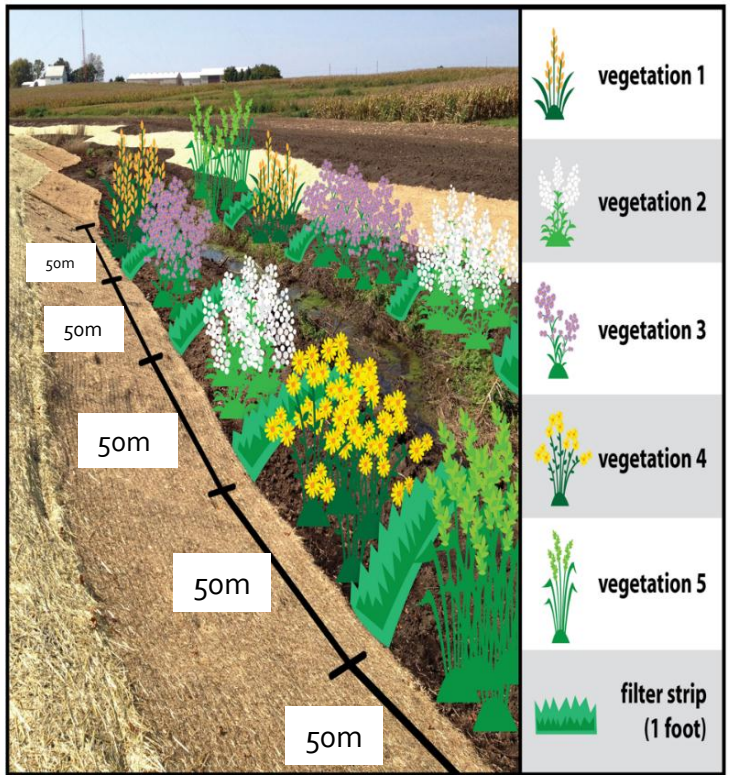

Spence mix

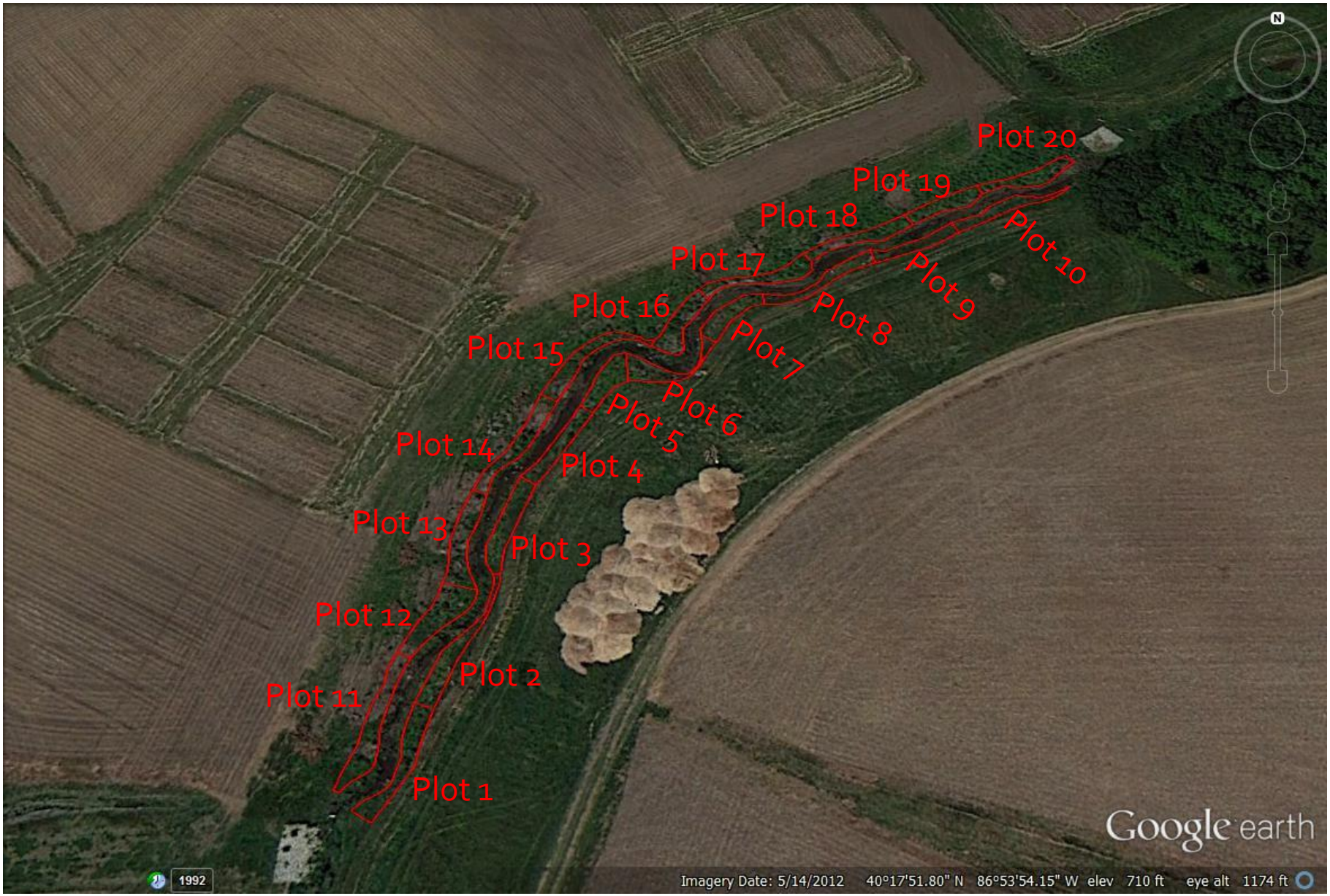

High Biomass


Retention

Experiment design

- 20 treatment plots installed, 4 replicates per 5 treatments
- Randomized plot arrangement,
- Two replicates on each side
- Each treatment extends approx. 50m along the ditch, for an area $33 - 40\ m^2$




Plot 20
Plot 19
Plot 18
Plot 17
Plot 16
Plot 15
Plot 14
Plot 13
Plot 12
Plot 11
Plot 10
Plot 9
Plot 8
Plot 7
Plot 6
Plot 5
Plot 4
Plot 3
Plot 2
Plot 1
N
Google earth
1992
Imagery Date: 5/14/2012 40°17'51.80" N 86°53'54.15" W elev 710 ft eye alt 1174 ft

Monitoring the benches

Stand count

- A metal frame containing 25 cells (5×5) of is thrown 4 times within each plot.
- If there is one or more plant in the cell, counts as "plant cell"
- Stand count = plant cells/100

Biomass sampling will be performed toward the end of the growing season to test for nutrient concentrations in the shoots.

Topographic surveying

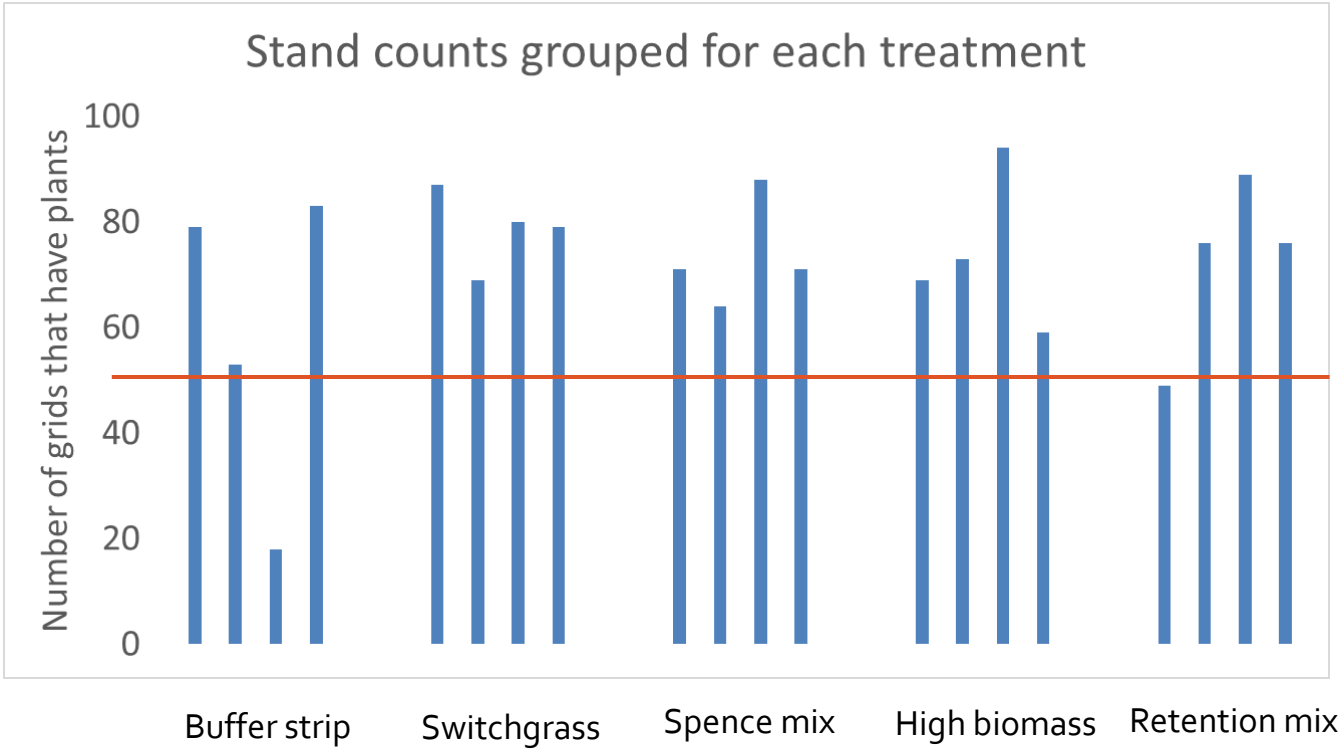
Monitoring the benches

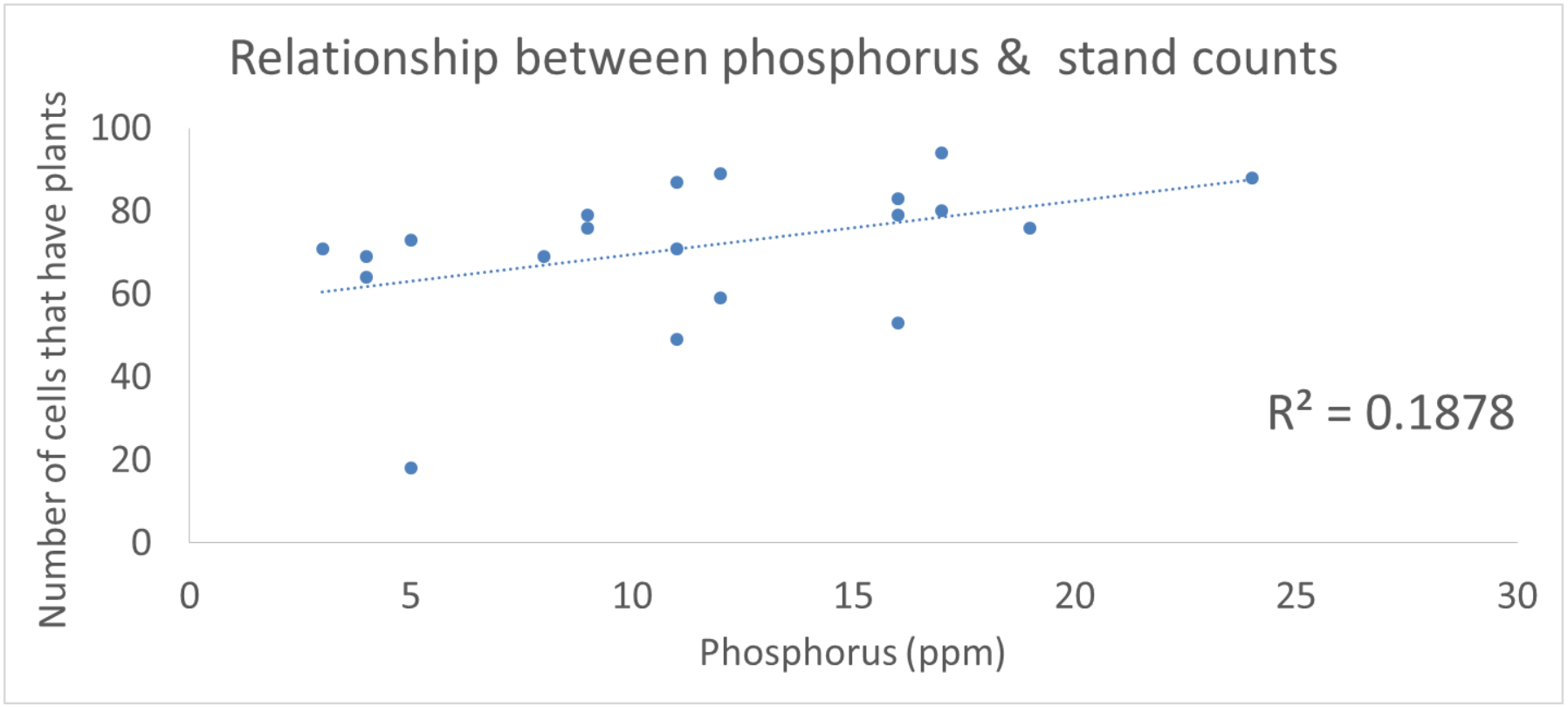
- **Wells** that monitor the hydrology of the benches
- **Iris tubes** give an indication of the reduction potential in the soil, indicating that conditions are right for denitrification

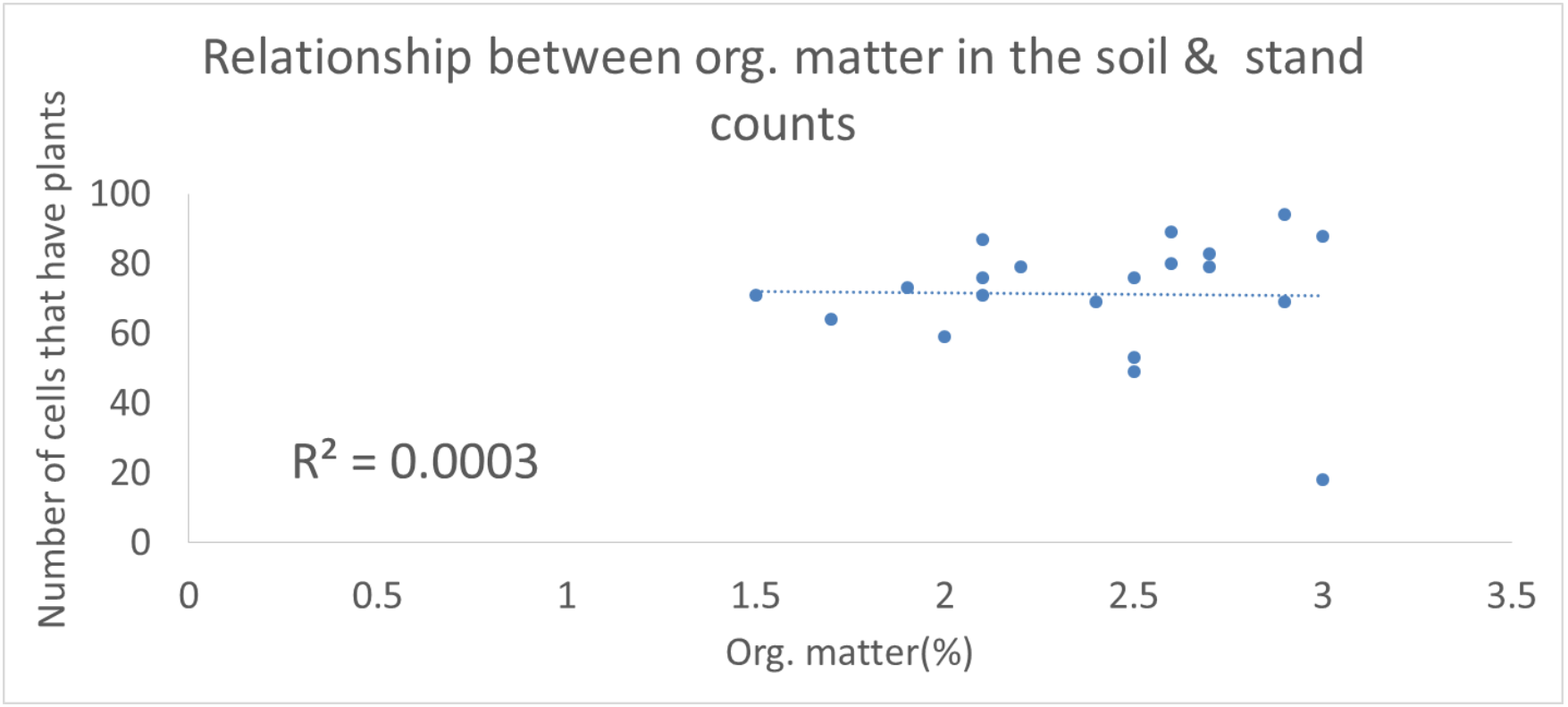
Soil test results from all the plots for soil depth 0-20 cm

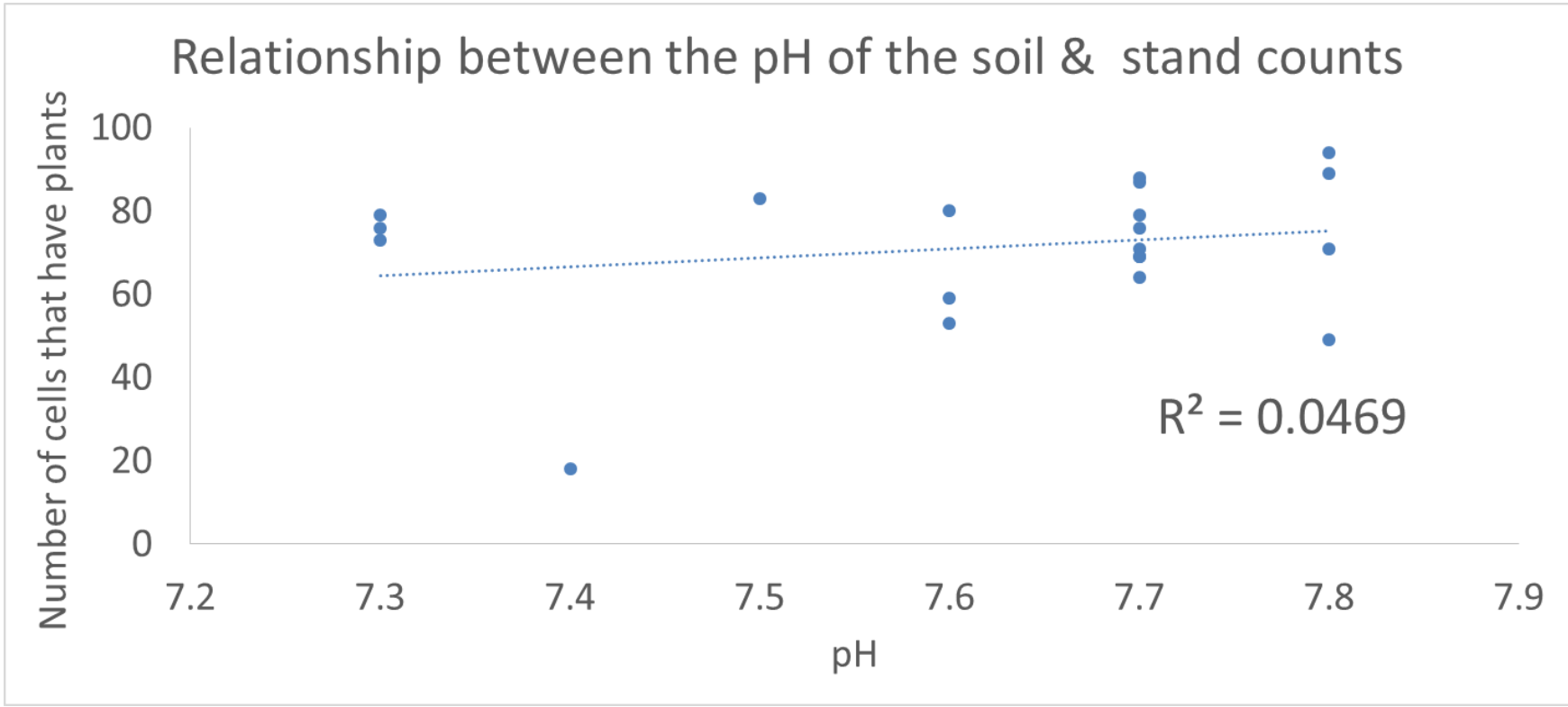
	Critical value for crops	Mean	Range	St. deviation
Org. matter(%)		2	1.5 - 3	0.4
CEC (meq/100g)		17	14 - 20	1
Phosphorus (ppm)	15	11	3 - 24	6
Potassium (ppm)	118	64	45 - 80	9
pH		7.6	7.3 - 7.8	0.2

Stand counts performed August 14, 2013

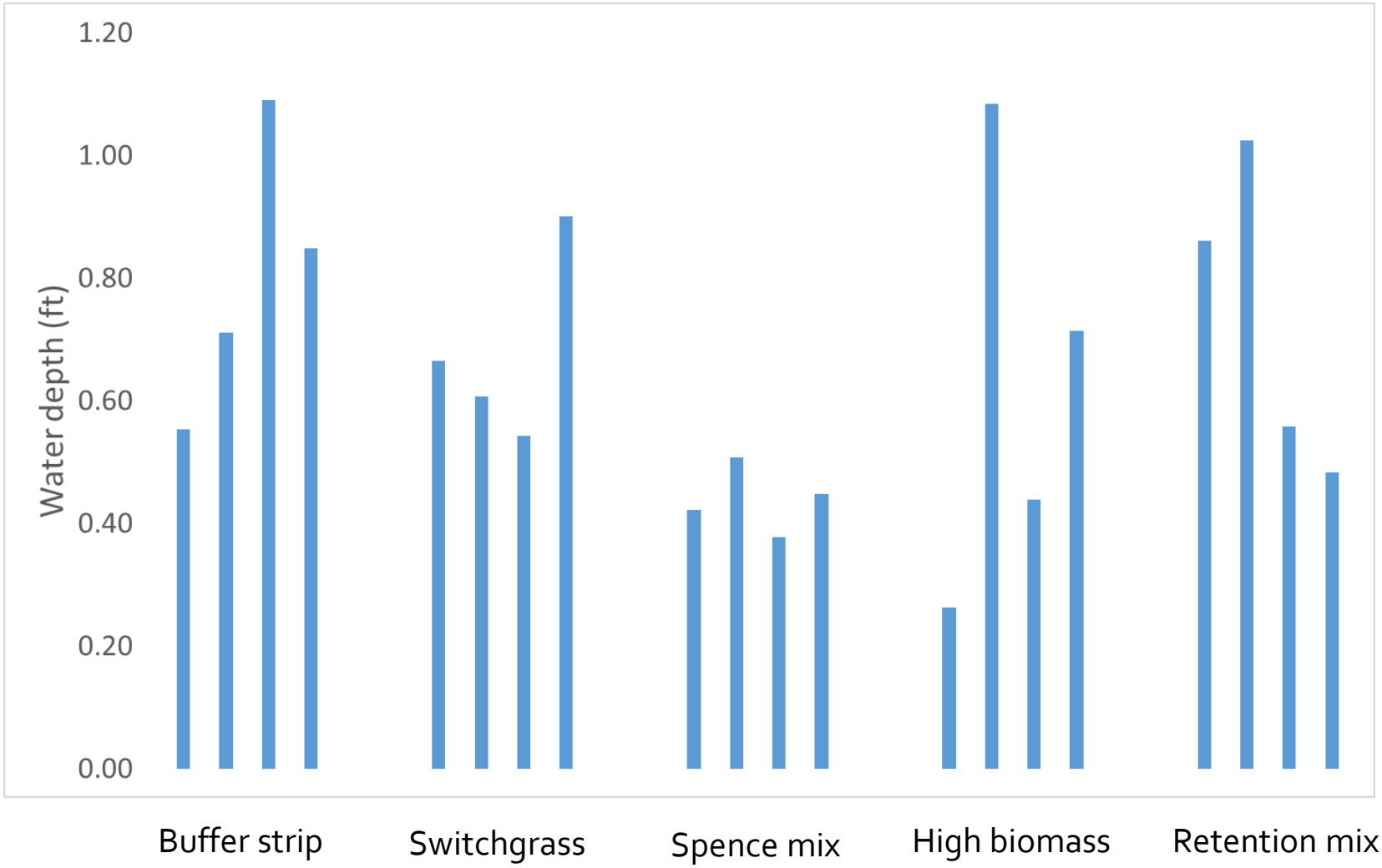


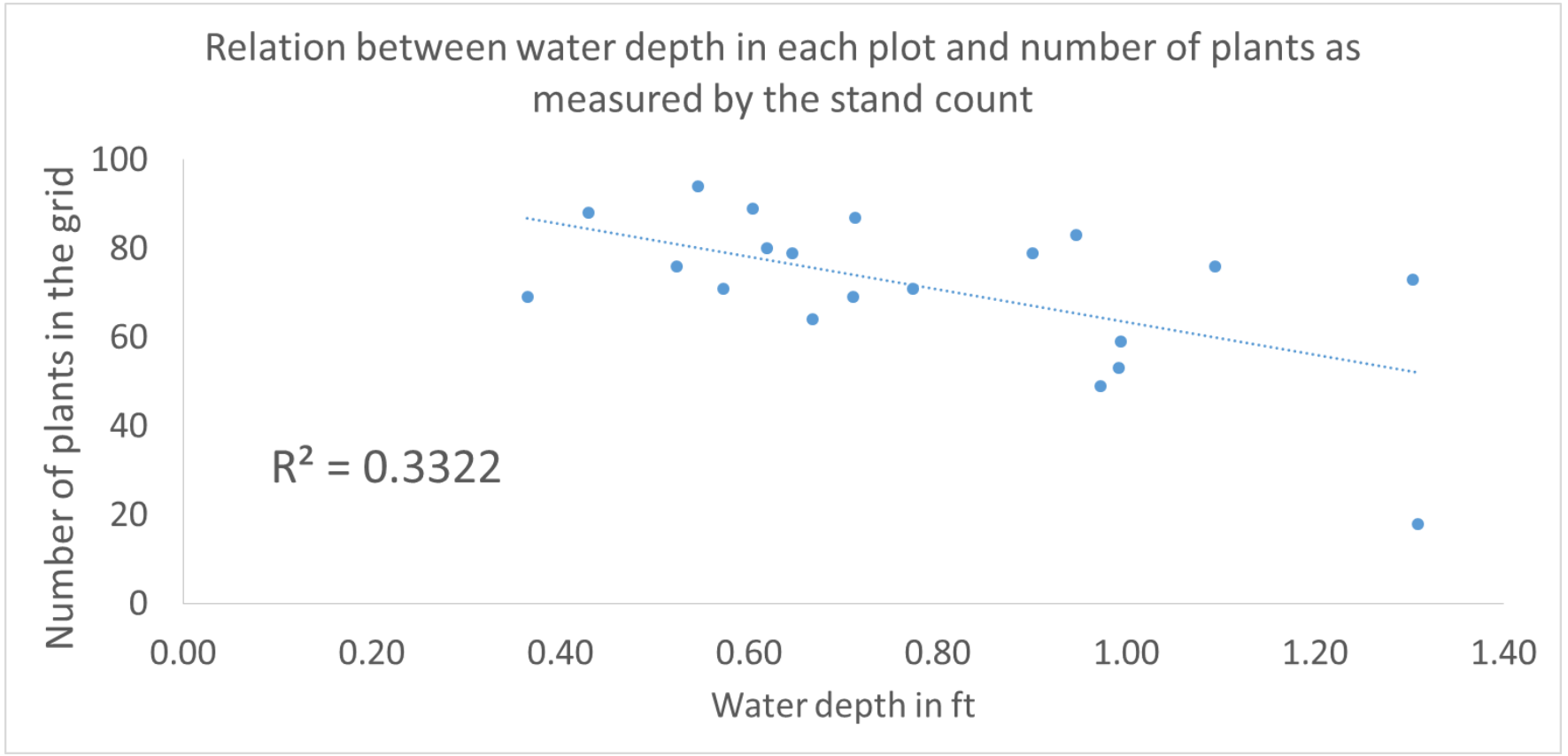

Relationship between phosphorus & stand counts
Number of cells that have plants
100
80
60
40
20
0
0
5
10
15
20
25
30
Phosphorus (ppm)
R² = 0.1878


Relationship between org. matter in the soil & stand counts
Number of cells that have plants
100
80
60
40
20
0
$R^2 = 0.0003$
0
0.5
1
1.5
2
2.5
3
3.5
Org. matter(%)


Relationship between the pH of the soil & stand counts
Number of cells that have plants
100
80
60
40
20
0
7.2
7.3
7.4
7.5
7.6
7.7
7.8
7.9
pH
R² = 0.0469

Water depth in the wells for period November,2013 – April,2014




Relation between water depth in each plot and number of plants as measured by the stand count
Number of plants in the grid
100
80
60
40
20
0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
Water depth in ft
R² = 0.3322

Summary

- The soil characteristics are similar in all plots so as to not have any significant impact in the establishment differences between the five different mixes.
- So far, 2 of the 20 plots show a stand count ratio above the 50/100 which is considered a minimum threshold that indicates plant establishment.
- The next stand count will give us a better indication of any differences in the ability of these mixes to establish, especially after this heavy winter.
- The biomass analysis for nutrients, coupled with the iris tubes results, are expected to give a better indication of the plants' ability to reduce the nutrients from the soil-water system in the benches.