Shallow ground water-tables influence corn and soybean root growth in Iowa

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Introduction

Because...

- Roots is the plant tissue interacting with soil properties and nutrients.
- Roots is the tissue with potential to reduce adverse impact of N fertilization on environment.

What do we know about roots?

Difference:
1. root type
2. root architecture
3. root length

Objectives:

a) Understand root physiological attributes responsible of root growth and development.

b) Determine maximum root depth and speed of growth.

c) Analyze distribution of root mass, length, C/N ratio (on and btw row).

Crop yield determination

Yield
- Grain number & grain weight
- Genotype
- Environment
- Interactions

Why are roots important?

- Provides a strong anchor for the plant
- Nutrient acquisition and utilization
- Soil carbon economy

Root traits may change depending on soil conditions and Water Table (WT) dynamic (flood and/or drought).

In which is expected:

- Shallow WT = Shallow root depth
- Deep WT = deep root depth

Materials and methods

20 site-crop-management in the State of Iowa

- Undrained condition
- Drained condition

Root length measure
1. In-season manually using conventional probe.
2. At max root length using an hydraulic probe.

Corn (early and late planting)
Soybean (early and late planting)
Corn single planting
Soybean single planting
Ongoing experiment: root mass, root length and root density determination.

**Materials and methods**

**Root sampling in-season**

**Approach 1.**
- Root sampling every ~10 days from V4 to R5 in corn and from V4 to R5 in soybean.
- Measurements on the row and between two rows.

**Root sampling at maximum root depth**

**Approach 2.**
- A single root sampling was performed using a hydraulic probe when a maximum root, R5 in corn and R5 in soybean.
- Measurement on the row and between two rows.

Maximum root depth → positive relationship between exploratory variables.

Correlation coefficients → always positive and significant. Close bars in row, open bars between row.

The values ranged from 0.52 - 0.95 for corn and from 0.54 - 0.94 soybean.

**Results**

Exploitation of root mass, root length and root density determination.

**Expectations**

**Vs**

**Reality**
Conclusions

Corn and soybean roots increased by about 2.5 cm per day (inches per day)
Max root depth similar between corn and soybean and about ~150 cm (50 inches)
GDD 10 best predictor

Implications

- Detailed field measurements at high resolution to develop parameters for crop models (example modeling work/below)
- Much of the root increase occurs in June (rate of 25 mm day$^{-1}$). This June was drier than normal (50% less rain) and this means that we will repeat the work in 2017

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http://crops.extension.iastate.edu/facts/

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