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Annual Crop Rooting Depth: What do we really know?

K. Brandt[1], H. Wang[1], E. Johnson[2], D. Ulrich[2] and S. A. Brandt[2]

[1]Semiarid Prairie Agricultural Research Centre, Agriculture and Agri-Food Canada, Box 1030, Swift Current, SK S9H 3X2. (Kelsey.Brandt@agr.gc.ca)
[2]Agriculture and AgriFood Canada, P.O. Box 10, Scott, SK, S0K 4A0

Introduction

Three annual crops and one weed species were grown as a demonstration plot at the Scott Experimental Station as part of their annual field day. These plots were meant to demonstrate new technology available to measure root growing in the field and to compare rooting depths of these various plants. Previous and ongoing root based studies at Swift Current formed the basis for this demonstration. These studies at Swift Current include root work on various annual crops under extra tall stubble as well as native and tame forage species on existing studies.

Figure 1: Demonstration site at the Scott Experimental Station

Materials & methods

Four plots were seeded with Canola, Lentils, Wheat and Green Foxtail.

Using a slide hammer and an alignment frame set at a 45º angle, a three inch soil core 150 cm long was removed from the ground. A 180 cm long clear acrylic tube was then inserted 150 cm into the ground for us to capture root images.

Weather information such as precipitation was collected from a nearby meteorological site.

Root images were collected by inserting a CID Biosciences CI-600 root scanner attached to a depth gauge into the tube and collecting images at various depths on a laptop computer. These images were then stacked one on top of another to give a view of the entire tube.

Results & discussion

Figure 2: Stacked photos of the rooting zone of Green Foxtail, Lentil, Canola and Wheat

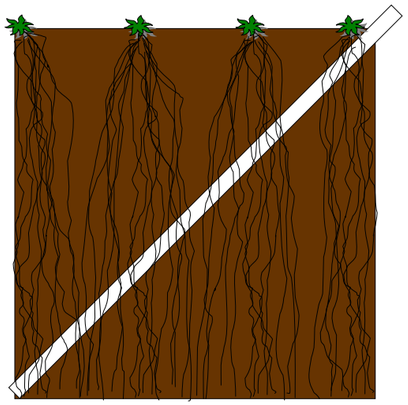

Figure 3: Cross section view of profile containing minirhizotron tube

In Figure 2, the entire rooting profile of each crop is visible. On the left side of the Green Foxtail and Canola is the scale for the length of the tube, on the right of the lentil and wheat is how deep the tube is inserted into the ground on a 45º angle.

Wheat and canola roots are visible throughout the entire depth profile, while lentil and green foxtail roots are visible only at shallower depths. Root density is similar for both wheat and canola.

Figure 3, illustrates how the tube is inserted into the ground at a 45º angle, showing how several plants are measured with the root scanner.

Results & discussion

Lentils showed dense root growth to 70 cm, with limited root growth extending to 90 cm.

Green foxtail showed very dense root growth to around 55 cm, with limited growth beyond this.

Typically the Scott Experimental Station receives on average 347 mm of precipitation. By the day these scans were taken (July 13, 2010), 363 mm of precipitation fell as rain and snow. In a wet year it is generally accepted that rooting is shallow. The Scott Experimental Farm had received its mean annual rainfall by the measurement date and it is plain to see that the canola and wheat roots have extended beyond our measurement zone of 100 cm, and the crop was just flowering at the time the scans were made. The results were similar on studies at Swift Current.

Implications

Not much is known about root growth in annual crops. Research into in situ root development is lacking and could provide valuable information for plant breeders to enhance drought tolerance. This also gives a visual method to track root growth through the profile instead of inferring this information through water use. Monitoring root growth in this way is essential to understanding crop growth, as we have precious little information about what actually happens to plants beneath the soil surface, and could play a large role in management decisions. Understanding root development in the soil will further enhance our knowledge of plant development and agronomy in general. Currently at Swift Current we have minirhizotron studies monitoring the development of various annual crops as well as looking at rooting under different tillage regimes and fertilizer treatments. As well, we are monitoring several native and tame forage species.

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