

# USING SOIL AND GROUNDWATER DATA TO DEVELOP DROUGHT STRATEGIES

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## WHY DID WE DO THIS RESEARCH?

Drought can have a significant impact on crop yield, particularly for field crops that are not irrigated – like forage, wheat, soybean and corn. It is generally believed that adopting a no-till management system conserves more soil moisture, but there is a lack of scientific data to support this recommendation, especially under different crop rotations. This project analyses ten years of field data and uses a computer model with historic data to assess the impact of no-till and tilled systems on soil moisture and crop yield reduction due to drought.

The results of this 2013-2014 project are relevant for farmers and farming organizations, professional agronomists and government agriculture and water policy managers.



## HOW WAS THE RESEARCH CONDUCTED?

Soil sensors were installed at the Elora Research Station in Guelph, Ontario in both no-tillage and ploughed plots. The sensors measured soil moisture content to a depth of 1 metre. A crop rotation of soybeans, corn and winter-wheat was grown on all four plots and red clover was planted as a cover crop after winter-wheat harvest and nitrogen fertilizer was applied.

DRAINMOD, a sophisticated soil water budget and nitrogen partitioning computer model, was run for a 48-year period to assess the impact of drought on corn yield under sandy and loam soils in Guelph region.

A corn crop was simulated each year in DRAINMOD, along with the Guelph loam and Pontypool sand soil profiles. These two soil profiles were run separately with the same weather and crop conditions to assess the effects of soil texture on drought occurrence and corn yield impact.

## WHAT WERE THE RESULTS?

- Over 10 years, the no-tillage plots contained more soil moisture.
- Shallow soil with no-tillage had higher minimum and mean temperatures.
- An unexpected result was that soil moisture in the ploughed plots was higher at 40 to 70 cm soil depth.
- Soil moisture levels remained greater in the no-tillage plots during drought conditions.
- DRAINMOD showed that drought can have a substantial impact on crop yield in the long-term. Over 48-years, there was corn yield reduction of 24% for loam and 33% for sandy soils.

## WHAT ARE THE IMPLICATIONS FOR FARMERS?

A no-tillage system overall conserves more soil moisture than a tilled system. However, a layer of soil within the root zone of many crops may actually be slightly drier under no-tillage conditions, perhaps due to earthworm burrows affecting water drainage.

DRAINMOD showed that the majority of growing years were impacted by drought to some degree.

The question of whether conservation of moisture always results in greater crop yield during a drought is not easy to answer and requires further research. DRAINMOD should be applied to future climate data to predict future impacts on crop yield, as increasing temperatures may increase evaporation and decrease soil moisture further.

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