Crop Rotations and Cover Crop Effects
on Erosion Control,
Tomato Yields and Soil Properties
in
Southwestern Ontario

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The crop rotation and cover crop project was begun in April 1989 in response to a research recommendation from the OSMRSC in the early 80's. Funding to 1992 was provided by the Land Stewardship I program. The project is now partially funded by the Green Plan on Farm Research program of Agriculture and Agri-Food Canada and RCAT until March 1997 (1996 crop year). Some summer student assistance has been provided by OVGMB. The project is located at two sites, Leamington and Dresden on approximately 4.5 ha each.

YIELDS

Although the benefits from crop rotations have been appreciated by farmers for many decades, economics sometimes lead farmers to forget the effects. This project puts numbers to the situation which are very scarce in vegetable production in North America.

Crop rotations have been an effective way to improve and even out processing tomato yields over years. The five year average for the best four rotations has shown a 25.8% increase in yield at Leamington and a 40.8% yield advantage at Dresden over continuous tomatoes (or very intensive vegetable production). (Figure 1) This compares to a 10-12% benefit from rotations in field crop production.

![CONTINUOUS vs. ROTATED TOMATOES 1990-1994](image)

**Figure 1**
ROTATIONS

There are nine different rotations at Leamington and eight at Dresden. The best four rotations at each location are very similar.

<table>
<thead>
<tr>
<th>Leamington</th>
<th>Dresden</th>
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<td>CuGBT</td>
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<td>WWusT</td>
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The yield differences between the best four rotations are not statistically significant. While continuous tomato yields at Leamington have remained relatively static, those at Dresden have decreased since 1990. It should be pointed out that the CuGBT rotation has a rye cover crop annually and the primary tillage implement is a Glencoe Soil Saver. Considerable crop residue is at or near the soil surface and has not been a problem in planting tomatoes.

NITROGEN

Four rates of nitrogen (0, 45, 90, 135 kg/ha Dresden, 0, 60, 120, 180 kg/ha Leamington) were incorporated to study the carryover nitrogen from the use of legumes. Nitrogen does overcome part of the rotation effect but does not replace it all. Tomatoes have responded to the highest rate of nitrogen at both locations with the increase between the last two increments 1 ton/ha or less but still profitable. (Figure 2) Tomatoes after alfalfa or redclover have generally responded to 0 to 90 kg/ha of nitrogen. It should be pointed out that tomatoes yield higher after a legume at 0 kg/ha of nitrogen than continuous tomatoes at the highest rate.

![LEAMINGTON 1990 - 1993 TOMATO YIELD BY NITROGEN RATE](image)
CROP QUALITY

Crop rotation has also affected tomato colour with a lower agron reading compared to continuous tomatoes. This effect is less consistent from year to year than yields. Soluble solids and total solids have also been increased by crop rotations. This effect may be as much as 0.5 to 1%.

OTHER EFFECTS

Long term results have shown that crop rotations affects the nutrient content of tomato plants. The positive effects have been shown in nitrogen, magnesium, manganese and zinc (3 of which are not usually applied in fertility. Effects are more pronounced at Leamington than Dresden. Although seldom a problem, blossom end rot appeared to be most closely related to nitrogen rate. It was most prevalent at Leamington in 1991.

SOIL EFFECTS

Crop rotations have shown a positive effect on soil organic matter content, wet aggregate stability (a measure of soil structure), and bulk density (measure of compaction). Rainfall infiltration has been increased by the improved structure in the higher yielding rotations. Soil drifting or wind erosion has not been a problem with use of crop residue (straw), forage legumes or a rye cover crop.

SOIL ORGANISMS

Crop rotations have had a significant effect on at least 10 soil organisms. The addition of red clover or soybeans have significantly increased lesion nematodes but this has not apparently affected yields. In other words, the rotations with the highest nematode counts also were the highest yield in tomatoes. The same was true for verticillium. In six years continuous tomatoes has not caused a buildup of lesion nematodes at either location. The rye crop has not appeared to cause a buildup of nematodes either. (Figure 3).

![LEAMINGTON COVER CROPS 1993-94 TOMATO YIELDS](image-url)

**Figure 3**
COVER CROPS

Rye still appears to be a cheap, useful, and effective cover crop. Long term (5 years) has shown that it increases tomato yields 2 to 7 t/ha. This effect has also occurred in some rotations.

It would appear there are very positive effects in processing tomato production from a crop rotation. Therefore, if at all possible use a rotation that contains a high residue crop (winter wheat) or a legume red clover, or alfalfa or both.