Cantaurus, Vol. 11, 37-40, May 2003 © McPherson College Division of Science and Technology

The Effects of CRP on Earthworm Populations

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ABSTRACT

This is a study to see how the Conservation Reserve Program (CRP) has affected the earthworm population from land previously in crop production. CRP fields are fields that have been taken out of crop production and have wild grasses planted on them and left idle for 10 years. CRP is designed to preserve and maintain soil from erosion. In this study, soil samples were taken from a corn field and from a field that has been in CRP for the past 14 years. Both fields are in Gage County, Nebraska. Ground temperature, soil moisture, soil compaction, and percent of organic matter were used to determine how they may have affected the results. There were five different tests done during the summer of 2002. Multiple tests were performed because the soil was drier at sometimes compared to others, and soil moisture affects earthworms. If the soil is too dry for the earthworms, they will move down in the soil to more moist soil. But, after a big rain, they may move close to or to the surface if the soil is saturated. When the soil is saturated, earthworms emerge. They don't come to the surface because they would drawn, but because this is the only time they can travel on land without dehydrating (Agriculture and Agri-Food 2003)

Keywords*: Conservation Reserve Program (CRP), conventional till, no-till, organic matter, ashed.*

INTRODUCTION

It is known that once a field is taken out of crop production and placed in Conservation Reserve Program (CRP) that earthworm populations usually increase because of the higher content of organic matter and the fact that CRP fields can hold more moisture because all the soil is covered with different varieties of grasses (Johnson and Quarles 1998). With the ground totally covered, this slows down the evaporation process.

When CRP fields are put back into crop production, the crop's root growth increases (Johnson and Quarles 1998). This is because of earthworm tunnels that make the soil less compact. No-till cultivation is a better way of maintaining earthworm populations after a field is brought out of CRP than are standard practices (Kladivko 1996).

This study will help to show the benefits of CRP. It will help to show how earthworm populations are affected by CRP and how CRP affects the soil to benefit earthworms. Earthworms more often affect crops indirectly through their effects on tilth and drainage which help to slow down the erosion process. I believe that this research will help to show the importance of CRP because of its desired effect of slowing soil erosion. Soil erosion decreases both soil quality and water quality in lakes and rivers. 600 million tons of topsoil have been saved from erosion since CRP began in 1986(Kladivko 1996).

MATERIALS AND METHODS

The materials used consisted of a soil and grain temperature probe, a soil sampler, a soil compaction tester, a balance, an oven, and a spade.

One cubic foot of soil was selected by random sampling methods and was then dug up with the spade and was scattered over a large plastic sheet approximately three by five feet. A soil sample was taken with the soil sampler at a depth of 6 inches within the cubic foot sampled. The soil temperature was also recorded at this depth. An earthworm count was then taken by going through and counting each earthworm found on the cubic foot of soil that was scattered out on the plastic sheet. This process was done three times in the CRP field and three times in the cornfield which was in production. This test was repeated five times: May 18th, July 5th, August 3rd and 28th, and on September 21st, all during the summer of 2002.

In order to find the soil moisture content, the soil samples were taken indoors immediately from the field where they were then weighed on a balance and scattered out on paper plates. These plates were then placed in an oven at 100 degrees Celsius for 6 hours. When all moisture had been removed from the soil, it was taken out of the oven and weighed again. The difference was found between the first weight and the second weight. This was found by dividing the dry soil by the wet, obtaining a percentage which was then subtracted from one to arrive at the total percentage of moisture.

An organic matter test was also performed on the soil. After all the moisture had been taken out of the samples in the oven, they were then weighed. Then, they were placed in an oven that would ash them at 1000 degrees Fahrenheit for 5 hours, and then after cooling, they were weighed again. The difference between the weight of the soil before being ashed and after being ashed gave the percentage of organic matter. This was found by dividing the soil weight after being ashed by the soil before it was ashed; this gave a percentage figure which was then subtracted from one to find the amount of organic matter. The samples after ashing would be lighter because any organic matter would have burned up in the oven and only ash

(minerals) would remain.

RESULTS

Results from the tests are presented in the accompanying eight figures. The organic matter results in figures 7 and 8 from August 3 are missing due to loss of the soil samples.

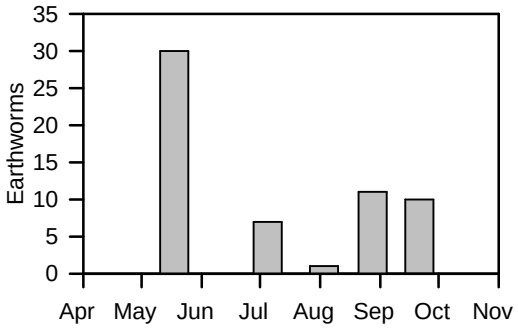

Figure 1. This figure shows the number of earthworms found during each test performed on a CRP field in Gage County, Nebraska. During the test, one random cubic foot was dug from three random areas in the CRP field and the number of earthworms found was totaled. There were five tests performed on different days through the summer of 2002: 5/18/02, 7/3/02, 8/3/02, 8/28/02, and 9/21/02.

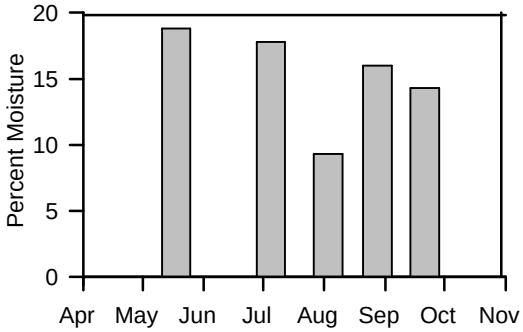

Figure 2. Here, soil moisture was recorded from soil samples taken at a six inch depth in the CRP field during the same time the earthworm count was taken.

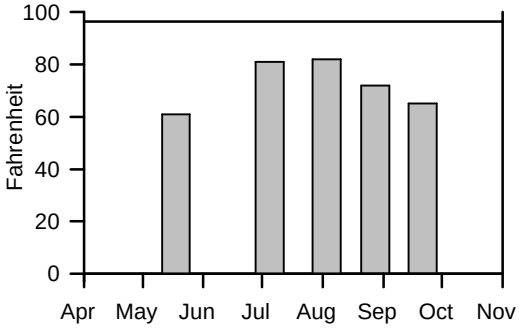

Figure 3. Ground temperature recorded in the CRP field at six inches when the soil moisture and earthworm count was taken.

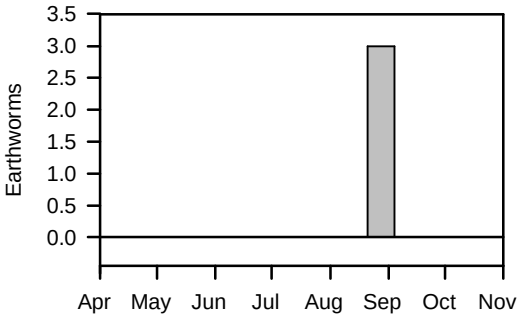

Figure 4. This figure shows earthworms found during five test dates in the summer of 2002 in a cornfield adjacent to the tested CRP field in Gage County, Nebraska. These tests were identical to the ones performed on the CRP field. Earthworms were only found on one of the test dates; the other test dates yielded none.

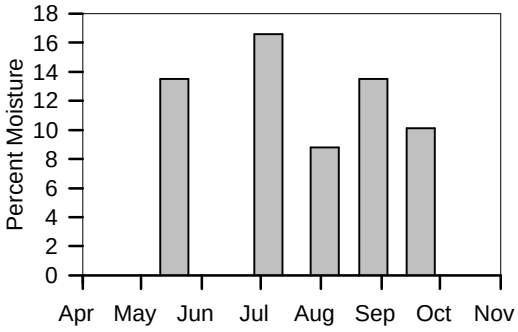

Figure 5. This figure shows the percent of moisture in the soil samples taken at six inches during the test dates on the cornfield in production.

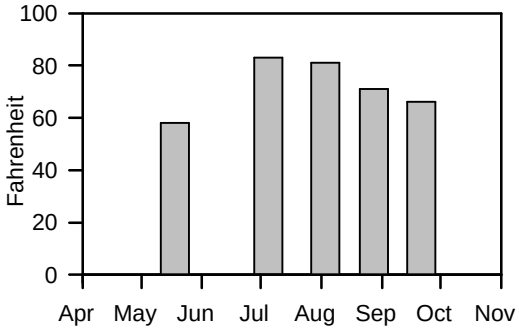

Figure 6. These are the ground temperatures recorded during the earthworm and moisture tests performed on the cornfield.

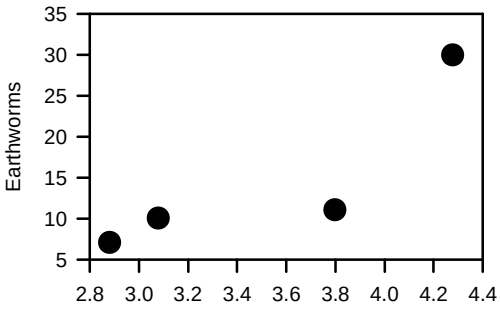

Figure 7. This figure compares the percent of organic matter to the number of earthworms found during the following four test dates: 5/18/02, 7/5/02, 8/28/02, and 9/21/02.

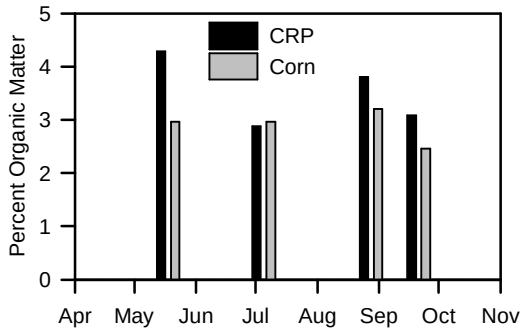

Figure 8. This figure shows the percent of organic matter in the samples taken in the CRP field and the producing cornfield. The samples had to be ashed in order to find the amount of organic matter. The results are from the same samples used to find the moisture content from the following test dates: 5/18/02, 7/3/02, 8/28/02, and 9/21/02.

Table 1.

CRP		**Corn**	
6 inches	80 psi	**6 inches**	210 psi
		9 inches	240 psi
12 inches	110 psi	**12 inches**	160 psi

Here are the results of a compaction test done on the two fields. Each test was performed in an area outside of the sampling area, but between where each of the three samples of soil were analyzed.

DISCUSSION

When counting earthworms in the two fields, only on one of five test days were any earthworms found in the cornfield, as seen in figure 4. In the CRP field, earthworms were found during every test day except for once as seen in figure 1.

On the date that earthworms were found in the cornfield, August 28th, the organic matter in the soil was also at its highest.

The single time that earthworms were not found in the CRP field was on Aug. 3rd, coinciding with the lowest amount of moisture in the soil. It is logical to conclude that during that sampling time earthworms must have gone deeper into the soil than that which was sampled.

The first test performed on May 18th found the most earthworms. On the date of the 18th I found the soil moisture at its highest, as seen in figure 2. The organic matter content was also at its highest, as seen in figure 8. During this first test on May 18th, the soil temperature was at its lowest compared to the other tests as seen in figure 3. The cooler soil temperature did not appear to affect the earthworms from staying deeper in the soil as was expected.

A pH test of the soil was not performed because earthworms are able to survive in an environment with low pHs, the predominant problem encountered in soil science. While earthworms prefer a pH from six to seven, they are quite able to survive in more acidic climates (Kladivko 1996).

The percentage of organic matter in the cornfield seemed for the most part fairly consistent, whereas the organic matter in the CRP field fluctuated more during each test as seen in figure 8. However, the average of the results for the two fields still shows the CRP field to have a higher percentage of organic matter by about half a percent. The percentage of organic matter in the CRP field declined throughout the summer one whole percent from 5-18-02 to 9-21-02, while the Cornfield's percentage of organic matter stayed about the same.

Figures 1-3 show for the most part how earthworm counts decrease as the amount of moisture in the soil decreases and as the soil temperature increases to a peak in the middle of the summer and then reverses back during the end of the summer. Figures 4-6 show the same thing for the most part in the corn field with the soil moisture and temperature, but earthworms were only found in one test out of the five taken from 5/18/02-9/21/02.

The compaction test shows that the cornfield was more than twice as compact as the CRP field as seen

in figure 1. This shows how earthworms loosen the soil, allowing for better root development and water percolation into the soil. Confounding factors include tillage and other human influences.

This research should help to prove how a field previously in CRP returned to crop production will benefit by soil that should produce higher yields in years to come.

How long higher organic matter, less compact soil, and saved topsoil will remain from converted CRP land and continue to benefit yields is hard to say at this time. More tests should be performed in order to see how long a field will reap the benefits of what CRP has left for it.

ACKNOWLEDGEMENTS

I would like to thank Dr. Jonathan Frye for his help in the lab and suggestions for helping me put this paper together. I would also like to thank Prof. Alfred Dutrow for his help and ideas in going about my research.

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