**Short and Medium Term Effects of Rotational Grazing and Haying on Soil Health, Pasture Diversity, and Macro Fauna**

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**OBJECTIVE**

To determine what effect rotational grazing and haying have on soil health, pasture diversity, and macro fauna over five to ten years of continued low input management.

1. How does the removal of organic matter by haying effect soil health compared to rotational grazing?
2. Does pasture diversity differ between haying fields and grazing fields?
3. Is there any correlation between pasture diversity and macro fauna?

**HYPOTHESIS**

The rotationally grazed pastures will test higher in N, P, K, and organic matter as well as demonstrating more diversity and numerical presence of forage species and macro fauna.

**METHODS**

Four farms were tested for rotational grazing and four farms were tested for haying practices. Only Lamoni Silt Loam, 5-9% slope, was tested to minimize the effects of soil type on saturation of nutrients, forage diversity, and the presence of macro fauna. Farms were selected on a volunteer basis in Northeast Missouri. Volunteers were offered a free detailed analysis of their pastures. Owners were provided with a description of the procedure that was used for collection. Farmers were provided a question sheet with the following questions about their land to determine testing sites:

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| How long have you owned this farm? | How far back can you tell me the history of these pastures with certainty? |
| What practices and machinery have been used on this field? When? | Provide a timeline of when and what animals were placed on this field? (If applicable) |
| What soil applications, seeding, or other inputs have been applied to this pasture? When? (If applicable) | Are there any unique spots that may skew analysis results? This includes spots that hold water, were recently cleared, parked equipment, feeding and watering areas, etc. for the history of the field. |
| When were each of the permanent fences installed? | When are temporary fences used? Have temporary fences moved, and where? |
| What is most valuable to you in a pasture? | What do you wish to improve in this pasture? |
| Do you participate in controlled burn practices? When has this pasture been burned? | Have you noticed any differences in the pasture since you’ve owned the land? Are there any annual fluctuations? |

I was provided with a quick tour of the pasture and how they preferred that I enter the field after each consultation.

The most up-to-date map of each farm was obtained from the University of Missouri Map Room. The sections of Lamoni Silt Loam, 5-9% slope were sectioned off into 1 meter2 sections and then numbered. This soil was selected because it is common in the rolling hills of Missouri and has a moderate percent of water retention and a moderate-high percent availability of water within the soil (Gerrish 25). A random number generator was used to select three sections from each individual farm. To prevent the effect of the migration of macro fauna in the soil column on the results, collections were taken at the same time of day and with relatively similar soil moisture levels. Due to the lack of a surveyor, locating a single square foot was difficult. For this reason, measurements were made to attempt to locate the center of each square meter section and data was collected from that point.

The first three fields collected were transported to the soils lab for analysis: Hay 1, Pasture 1, and Pasture 2. The remaining samples were collected and analyzed on site. Collection size was reduced from 12in3 to 9in3 due to the tools available for ease of standardization of samples. This was also the depth at which soil composition began to change drastically, therefore the shallower sample avoided skewing data results. This decision was made after collecting the first sample, which was retaken immediately next to the original hole.

Samples for composition testing were collected using a 1in x 12in core sampler. The middle third was taken from each core sample and measured to make one cup from each sample location. It was then mixed with the other two samples from the same field. Three samples per field were collected and mixed to minimize outliers as suggested by the University of Missouri Extension. Soil samples were taken to the University of Missouri Extension Office in Adair County for testing.

The 9in3 sample was removed using a square-tipped shovel. A tarp was laid out and the soil sample was placed on the center of the tarp. Each plant was individually removed at the root, identified, and documented. Dr. Mark Campbell, a professor at Truman State University, helped in the identification of forage species. The entire soil sample was then broken apart to uncover, identify, and record all macro fauna.

**ANALYSIS**

This data set is incomplete. There is not enough information to run statistical test. However, by looking at the current data, the trend seems to be much different than the original hypothesis. The hayed fields had a much larger population of macro fauna, while the rotationally grazed pastures had a greater population of forages. This could be due to the tamping of soil by the cattle forcing the macro fauna deeper. It could also be due to the great amount of rain received this year. These macro fauna migrate out of the soil when the soil is saturated, putting them at greater risk of being crushed or eaten by the cattle. The earthworms in the grazed pastures were clearly larger and healthier than those in the hayed pastures. Almost all the worms in the hayed pastures were grey and sickly, indicating that their food source was inadequate or an overpopulation problem. The greater population of forages for grazed pastures could be due to the high concentration of nitrogen and organic matter excreted by the cattle. The organic matter is removed while haying, which also removes vital nutrients from the soil. The recommended amount of fertilizer was added to the hay fields each year, but this may not have made up for the required organic matter. This year most likely caused leeching of the majority of this fertilizer as well, making it inaccessible to the forages. The diversity of forages was also greater in the rotationally grazed pastures. This is important is grazing, but can cause digestion problems in hay. Due to the lack of data sets, it is impossible to make conclusive analysis at this time.