5. When a tractor pulls a plow through an agricultural field, the energy needed to pull that plow is called the draft. The draft is affected by environmental conditions such as soil type, terrain, and moisture.

A study was conducted to determine whether a newly developed hitch would be able to reduce draft compared to the standard hitch. (A hitch is used to connect the plow to the tractor.) Two large plots of land were used in this study. It was randomly determined which plot was to be plowed using the standard hitch. As the tractor plowed that plot, a measurement device on the tractor automatically recorded the draft at 25 randomly selected points in the plot.

After the plot was plowed, the hitch was changed from the standard one to the new one, a process that takes a substantial amount of time. Then the second plot was plowed using the new hitch. Twenty-five measurements of draft were also recorded at randomly selected points in this plot.

(a) What was the response variable in this study?

The response variable in this study was the draft.

Identify the treatments.

The two treatments were the two types of hitches: the standard hitch and the new hitch.

What were the experimental units?

The experimental units were the two large plots of land.

* clear indication of the effect of the newly developed hitch on draft reduction.

(b) Given that the goal of the study is to determine whether a newly developed hitch reduces draft compared to the standard hitch, was randomization used properly in this study? Justify your answer.

Randomization was used properly in this study because the experimental units (plots) were randomly assigned to the treatments (hitches), thus reducing chance variation resulting from differences in the environmental conditions between each plot, such as soil type, terrain, and moisture. Moreover, the locations at which draft measurements were taken were also randomized in order to further reduce variability arising from differences in those same environmental conditions within each plot. For instance, the north end of a particular plot could have more fertile soil and less rocky terrain than the south end of the same plot. Thus, the results of the study should provide a relatively *

(c) Given that the goal of the study is to determine whether a newly developed hitch reduces draft compared to the standard hitch, was replication used properly in this study? Justify your answer.

Replication was <u>not</u> used properly in this study because the newly developed hitch was not tested against the standard hitch more than once. Ideally, the hitches should have been tested on multiple plots of land (more than two), so that the results of the study would be reliable. However, because the hitches were only tested on one plot of land apiece, it is not reasonable to draw conclusions about the draft-reducing capability of the newly developed hitch from the study's results.

(d) Plot of land is a confounding variable in this experiment. Explain why.

Plot of land is a confounding variable because the variability inherent in each plot's environmental conditions, such as soil type, terrain, and moisture can potentially have a large influence on the measurements of the response variable - draft, thus making it unclear whether the difference in the type of hitch or differences in the plots' environmental features, affected the measured differences in draft.