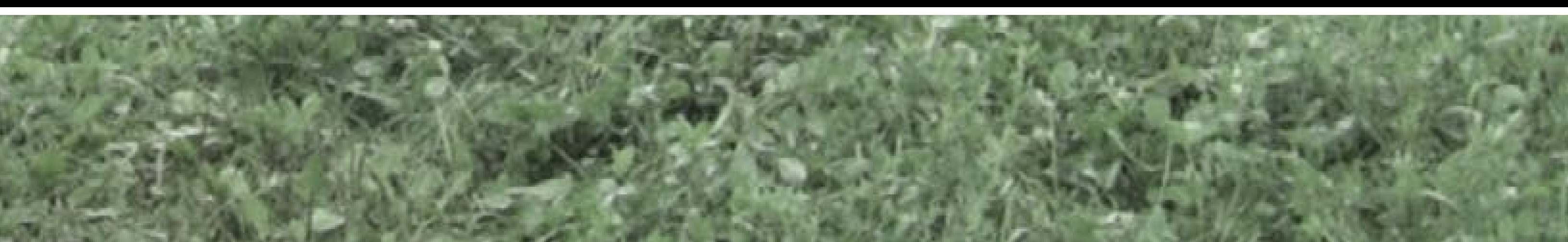
A Practical Guide to

ON-FARM PASTURE RESEARCH

Designed for farmers and graziers interested in conducting research into the effect of a product or practice on their soil and forage.



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A PRACTICAL GUIDE TO
ON-FARM PASTURE RESEARCH

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On-Farm Pasture Research

Farmer implemented, farmer managed research projects can provide fact-based answers to a farmer's challenging questions. On-farm trials have the potential to improve production efficiency, farm profitability and environmental stewardship. By conducting the research in a controlled way, the results also offer other farmers and researchers valuable information.

PASTURE BASED RESEARCH

Because of the diversity of both plant species and soil conditions within a pasture, conducting research poses unique complications that need to be taken into account. Pastures are incredibly diverse with daily and seasonally fluctuations in growth rate and forage quality depending on weather conditions, soil types, grazing management, and plant communities.

In most cases, researchers cannot simply define the success of their study using a single measurement of yield or growth at the end of one year. To accurately quantify the worth of a pasture, one needs to know both the productivity and quality of a wide variety of grasses multiple times throughout the year. As plants and soil within pastures tends to be highly variable, these measurements can be difficult to collect.

To compensate for these obstacles, there are special sampling protocols specific to pasture research. The following information will guide you through the process of setting up an on-farm pasture-based research project. Although there are different ways to conduct this type of research, this guide will present a simple methodology that can be useful for many types of on-farm pasture studies.

ON-FARM RESEARCH: STEPS TO SUCCESS

These four questions provide the foundation for your project. The two steps following them are the actual project. Your answers to the questions will help you develop your research project.

- **What are you interested in knowing?**
  Develop a clear simple question with a definite, quantifiable answer.
- **What practices are you interested in testing?**
  Define the "treatments" of the study. It is advisable to keep treatments simple, practical and well defined. When trying to test several treatments, the experimental design and the statistics to interpret results get much more complicated. Most of this guide is designed to have only one test treatment which is then compared against a "control" treatment which would be your normal practice.
- **Where and how will you conduct the experiments?**
  Select portions of your pasture that are most uniform. As an experimental design, select four to seven paddocks that serve as replications in which to place your treatments.
- **What will you measure and how?**
  Consider the time and expense to adequately collect your data? If pasture yield is important, how will you measure it? What about animal data?
- **Collect enough research data to draw good, reliable conclusions.**
  Because pastures can be so variable, you'll have to collect several samples from each research plot or strip experimental unit in order to calculate an average value. Animals also vary so it is best to measure groups of animals for a treatment rather than just one or two animals. The method of splitting animals into different treatment groups is also important.
- **Disseminate your findings!**
  Congratulations! You've finished and are ready share your exciting results. Be willing to talk about your study at pasture walks, workshops or grazing conferences.

STEP ONE
DEFINE THE STUDY QUESTION

Research often starts with a question.. The question should clearly state both what treatments will be examined and what variables will be monitored over the course of the study. (For more information on choosing your treatments and variables, see below.) Here are some general questions written by farmers and a corresponding research question.

General Question:	Research Question:
Should I inject liquid manure into my pasture?	Will injecting liquid manure into pasture result in a greater forage production and higher soil nutrient availability than one would expect by spreading a similar amount of manure.
General Question:	**Research Question:**
Should I plant brassicas to extend my grazing season?	What is the effect of hand seeded forage radish on forage quality and production during the fall months?

Notice how each general question was amended to be much more specific. The research question now includes information regarding exactly what the treatment will be, what you will measure to determine how effective the treatment is, as well as other useful details like the time-frame of the study. Having a well-defined research question will help you stay focused.

STEP TWO
CHOOSE TWO TREATMENTS (2)

If you designed your research question well, the treatment should be clearly laid out in the research question. Common examples of treatments include, a certain fertilizer applied at a certain rate, a new plant species seeded into the pasture, and an innovative plowing technique.

It is important to include a "control" group to contrast against the "treated" group. The control plots will not receive the treatment under investigation. Below are examples for treatment/control combinations for the examples listed in step 1.

General Question:	Treatment:	Control:
Should I inject liquid manure into my pasture?	Liquid Manure Injection (5-tons/A)	Manure Spread Over Surface (5 tons/A)
General Question:	**Treatment:**	**Control:**
Should I plant brassicas to extend my grazing season?	Pasture with forage radish hand seeded (at 20lbs/A)	Standard Pasture

Key Vocabulary

Treatment: A specific experimental condition imposed in a study

Example: *For pasture studies, a treatment might be a specie or variety (ie., perennial ryegrass) , a soil amendment (ie,lime), a management practice (ie, grazing height).*

Experimental units: The individual plot, strip or area receiving a treatment.

Example: *In the pasture above, each of the three sections is an experimental unit.*

Variable: What you measure or observe to determine the treatment impacts;

Example: *Common variables a researcher measures include soil pH, forage protein and energy content, pasture*

STEP THREE
HOW AND WHERE WILL YOU CONDUCT THE STUDY

Selecting the Location

Location is very important. When choosing a site, consider previous crop history (fertilizer rates, herbicides, tillage, etc.), drainage, forage species, soil texture, soil depth, topography, pest infestations, and other factors. Choose a field site with the greatest possible uniformity. The goal is to plan and organize the field plot layout to assure that all treatments have an equal opportunity to succeed.

For pasture research, you will want a fairly large tract of land, usually enough for at least 6 paddocks or about 3 acres. The study will be easier if you use established, permanent paddocks, even if they are only permanent for the length of the project.

Plot Layout: Paired Design (Side By Side Comparisons)

The experimental design described below is known as a "Paired Comparison Trial." This on-farm design is characterized by having long strips of treated and untreated land side-by-side in the field, replicated at least six times. Each pair of strips should be located in an area that is fairly homogeneous or uniform. (See figure on page 5)

Paired comparison trials are well suited to pasture research. By replicating the treatment within every pasture many factors, such as grazing use, are kept constant. The design is fairly simple to understand and implement; each data pair yields one difference. These differences can be analyzed using a simple, single-sample technique described on page 12. In addition, the results are clear and easy to interpret.

Replication

When using a paired design, it is best that the treatment/control plots be paired at least six times, making six replications. This gives you some leeway if one or two plots fail but is not too difficult to complete practice implementation and sampling.

Replication gives you a "second opinion" on your question. With only one pair in the trial, the conclusion is based on only one observation – which may or may not be representative of the result. You would not know if the results you saw were a random fluke or a real treatment effect. By replicating the experiment in multiple places, you can be certain that the effect measured is more likely to be real.

Creating Experimental Units

If conducting the experiment in established paddocks that have set perimeter fences, creating experimental units is relatively easy. Mentally split each paddock roughly in half; each half will be one experimental unit. Each paddock is one replicate and will contain one pair of treatments (treated and control). You will need six paddocks to complete this experimental design. See the sketch below.

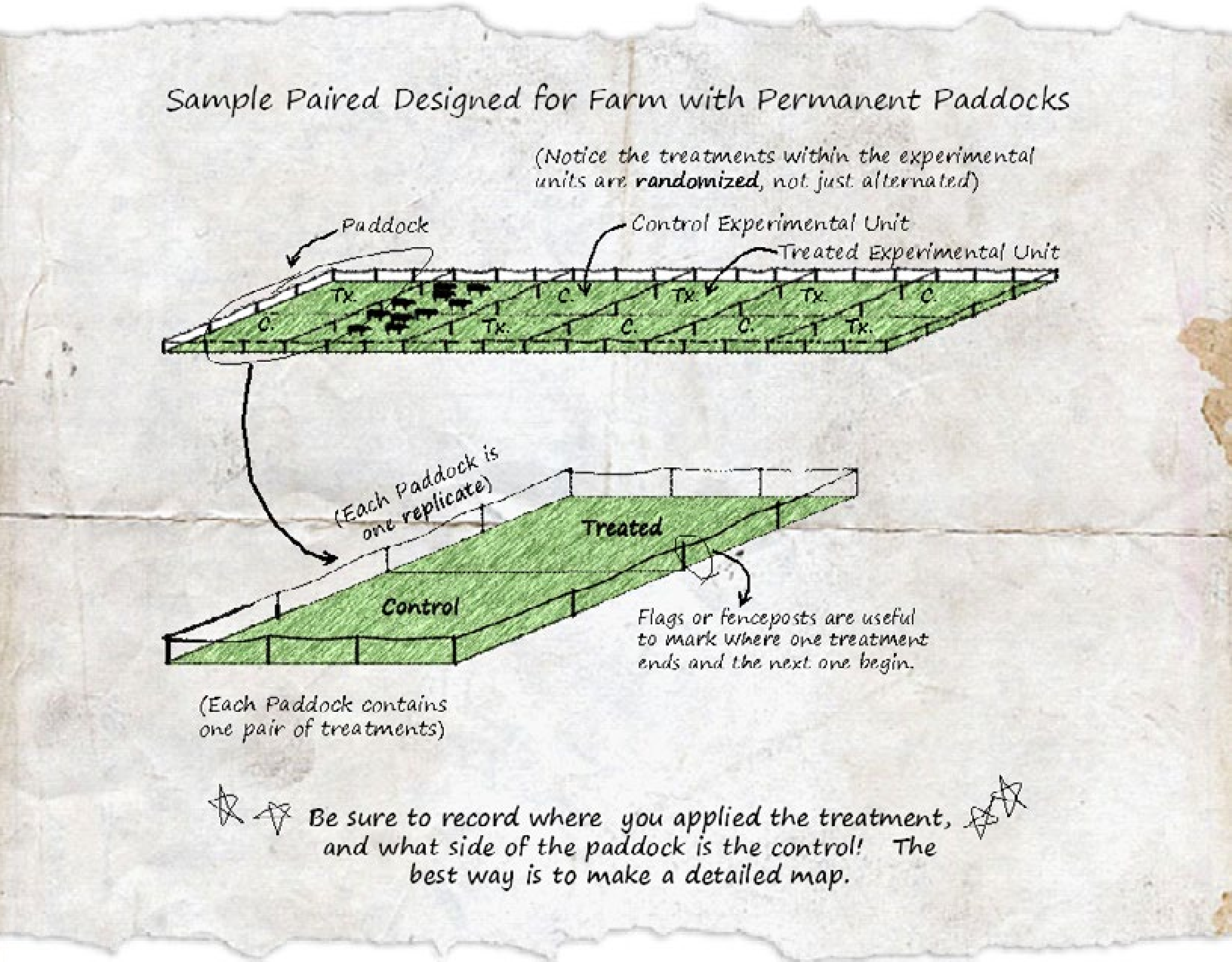
If conducting the experiment in an area that is strip grazed, setting up the experimental units will require a bit more work. You will be applying the treatments in long narrow strips. Each strip will be one experimental unit. Two adjacent strips will be paired. (It is helpful, if you are applying the treatments with a tractor, to make plots that are field length long and one or two tractor passes wide. This makes it easier to apply treatments along the entire strip without having to start or stop in the middle of the field.) Decide what width you would like each strip to be; use flags or markers to mark the chosen interval within the field.

Randomize Treatments within Experimental Units

To prevent unanticipated sources of bias from entering your data measurements, treatments must be randomized. This means that the order of treatments cannot be the same in every replication. Within each pair of experimental units, randomly assign which side will be treated and which side will be the control by flipping a coin.

Draw a Map and Keep Good Notes

Once you've laid out the study, draw a good map indicating the location of each plot with its assigned treatment.



STEP FOUR
CHOOSE VARIABLES TO MEASURE

Once you have an experiment established in the field, there is no limit to the kinds of data you can measure: soil chemical properties, yield parameters, weed counts, forage nutritional value, etc. Measurements should be chosen from the list below depending on the outcomes you are looking to measure in the trial you are conducting. Please note there might be measurements specific to your trials which are not included below.

A few of the most common analyses are also described on the next two pages. With a little online research you can also find more information regarding how to properly take each measurement and interpret the results. Also consult your local extension agents; they can help you refine you experimental design and sampling procedures and may even be able to lend you some equipment.

Be sure that what you are measuring will be useful in answering your research question. It is easy to overextend yourself by measuring more variables than you have time or money for. We recommend focusing on two to four variables.

Measurement	Cost	Time	Equipment
COMMON SOIL MEASUREMENTS			
Soil Organic Matter	$$	3	A
Soil pH	$	2	C
Soil CEC (Cation Exchange Capacity)	$$	3	A
Soil Nutrient Composition	$$$	3	A
Soil Moisture	$	2	C
Soil Temperature	$	2	B
Earthworms	$	3	A
Soil Compaction	$	2	B
Soil Infiltration	$	3	B
COMMON FORAGE MEASUREMENTS			
Percent Desirable Plants*	$	1	B
Plant Cover*	$	1	B
Plant Diversity*	$	1	B
Plant Residue (Standing Dead Matter) *	$	1	B
Percent Legumes*	$	1	B
Forage Quality	$$$	2	A

* Assuming visual assessment with quadrat is conducted

Table Key

Cost per Sample

$ = less than $1

$$ = $1 to $5

$$$ = over $5

Time Requirement per Replicate

1 = less than 1 hour

2 = 1 to 2 hours

3 = more than 2 hours

Equipment Requirements

A = no measurement equipment required

B = some low cost, simple measurement equipment required

C = expensive or sophisticated measurement required equipment

SOIL VARIABLES

Soil Nutrient Content

Required equipment: Soil Probe ($100.00)

A standard soil nutrient report can provide a lot of information about your soil. Most will include data regarding the sample organic matter content, pH, cation exchange capacity, percent moisture, and concentration of key macro- and micronutrients (excluding nitrogen). This is a great variable to measure when you are testing a new fertilizer or amendment.

Collect composite samples by getting soil from 20-30 random spots in each plot. Pasture should be sampled to a depth of 4 inches using small soil probe. Once you have collected a composite sample from one plot, mixed it up, bagged it, and labeled it, then go on to the next plot. You will end up with the same number of samples as plots.

Select part of the composite sample (approximately 1 cup) for analysis. Samples can be sent (dry or fresh) to your local Land-Grant University Agricultural Testing Lab. You should check with the lab before sending samples to see what they routinely measure. If you have any additional needs, they may charge you extra.



Series of images depecting a soil sampling probe with core, a bucket for mixing samples, and a bag of soil samples.
(Ontario Ministry of Agriculture and Food)

Soil Compaction

Required equipment: Compaction Meter or Penetrometer ($150.00-$250.00)

Soil compaction is common in many pastures, particularly when animals are allowed to graze wet soils. Compaction destroys structure, reduces porosity, limits water and air infiltration, and increases resistance to root penetration. If you were planning on physically altering the soil (aerating for examples), you may want to measure the soil compaction.

Measuring soil compaction using penetrometer.
(University of Vermont)

Walk around the experimental unit and measure the soil compaction in at least 30 random locations following the instructions provided by your penetrometer manufacturer. Take care to collect readings from the sample soil depth at all locations. Use the average of all readings as the soil compaction value for the experimental unit.

Soil Moisture

Required equipment: Soil Moisture Meter ($30.00-$250.00)*

In non-irrigated pastures, soil moisture is often the largest factor determining plant growth. Any physical changes you make to the soil (such as sub-soiling) will affect the way your pasture drains and stores water; therefore, measuring soil moisture throughout the season may be a useful measurement to help explain if you get a difference in treatments.

To measure soil moisture content, walk around the experimental unit and measure the soil moisture content in at least 30 random locations following the instructions provided by your specific soil moisture meter. Be sure to collect all of the measurements on the same day, from the same soil depth, at all locations. The soil moisture value for the experimental unit will be an average of all 30 readings from the experimental unit.

FORAGE VARIABLES

MEASUREMENTS OF FORAGE MASS/YIELD

The growth rate of pasture is a function of the soil nutrient availability, moisture, compaction as well as climate and land use history. Any time you are applying a treatment with the aim of achieving greater production, consider monitoring forage mass. In a rotationally grazed pasture, you would normally want to measure pasture mass just before the plots or strips are grazed preferably the morning of or the day before.

In standard scientific research, forage mass is estimated using hundreds of carefully clipped, dried, and weighed forage samples. This method is very time consuming and requires equipment lot of labor. However there are other relatively easy and efficient means of indirectly measuring the forage mass within a pasture. Two common produces are outlined below.

Measuring Forage Mass using Falling plate meters

Required equipment: Falling Plate Meter ($30.00-$400.00)*

There are two types of plate meters available; rising plate meter are available commercially for $200 to $400. Falling plate meters are relatively easy to construct for about $30.00 (See http://www.wvu.edu/~agexten/ forglvst/fallplate.pdf for construction details.) Falling plate meters measure the compressed height of the pasture canopy. To measure forage availability using a plate meter, select random locations in the pasture, gently place the meter on the forage until the plate is supported by the forage, then measure the height of the plate's top above the ground. Use the average of all of the height values as the value for experimental unit.

Homemade falling plate meter.
(Practical Farmers of Iowa)

Measuring Forage Mass using a Pasture Stick or Ruler

Required equipment: Yardstick ($5.00)

You may also use a special pasture stick or even a simple ruler to estimate the pasture mass. This method assumes that as the sward height increases, forage yield increases. If you choose to use this method, walk around each experimental unit and select 30 random points; use the ruler to estimate the height of the sward disregarding any weed species or outliers. Use the average of all of the height values as the true value for experimental unit. A measurement of pasture density will help calibrate this value. As you know, a more dense pasture will have more forage than a sparser pasture.

Forage Quality

Required equipment: None

Forage quality has a direct effect on animal performance, forage value, and profits. It is strongly influenced by the population of plants in the pasture and timing of grazing. Forage quality analyses are useful whenever you are interested in the impact of a new species of forage or a new system of grazing.

Pasture samples for forage quality should be taken before animals are turned into the pasture. Walk around the experimental unit and collect 30 grab samples with your hand or scissors; remove the forage to the height the animals will graze. Samples must represent what livestock will eat. Once you have collected the subsamples, thoroughly mix them together. Select part of the combined sample for analysis. Samples should be either dried at 140°F or frozen immediately after collection. The samples can be sent to any forage testing lab for analysis. You can chose to measure the entire suite of forage quality parameters (about $16 per sample) or an individual parameter like NDF of crude protein content for less money.

BRIX Content

Required equipment: Refractometer ($30-40)

The brix reading on a plant is an indication of its nutrient content; it refers to the total amount of soluble solids (mostly sugars) along with plant proteins, vitamins, and minerals. Consider measuring BRIX whenever you suspect the treatment influences forage quality.

To determine the average brix content of you pasture, select one dominate plant species to work with. Since brix values fluctuate throughout the day, We also recommend collecting your samples at the same time of day over the duration of the experiment. Collect blades of grass from the same species of roughly the same maturity from at least 30 location in you pasture. In small batches, roll the leaves between your palms for 15 seconds. Then place the specimen in garlic press to extract the juice. Use a refractometer, also called a brix meter, to measure the solute content.

Visual Assessments for Various Measures

Required equipment: Hula hoop

Visual assessments are relatively quick but do require some calibration of the eye and practice if they are to have any value. Also, randomly choosing the sites to visually assess is important in order to avoid any bias of the data. Many visual assessments involve a rating system such as 1 to 5 or 1 to 10. They may also be a visual estimate of a percentage such as percent residue or percent legume in the mix. Using a hula hoop, you can walk a zigzag pattern through the pasture plot throwing the hoop in front of you. For each throw, you would record your visual appraisal within the hoop boundaries and for each plot or experimental unit, it would be best to appraise at least 20 spots.

STEP 5

CONDUCTING THE EXPERIMENT

Develop a Project Timeline

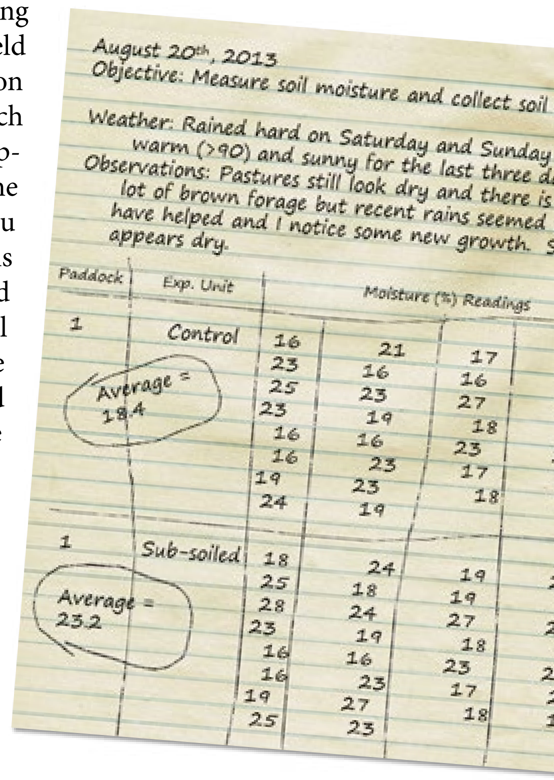
Every trial is different and will require a different timeline. In general, most studies are conducted for at least two years. You will likely collect data regarding the pasture and/or soil quality at multiple times during the years. That said, it is important to not over-commit yourself. Research can be very time consuming and tedious – for instance, expect sampling forage quality in 12 experimental units (6 paddocks) to take at least 4 hours; collecting soil samples will likely take longer.

Take Notes

Recommendation:

"Rite in the Rain" all weather notebooks are expensive but well

Keep detailed written records of everything you do related to the project. Record all field operations in diary format. Take notes on the methods of your field operations, such as the type of equipment, depth of tillage operations and materials applied to either the whole field or to just one treatment. You should also include personal observations about the weather, pests, forage growth and development, etc. These will be essential when you got to interpret the data. The documentation also preserves the detailed of your farm trial so that you can share the information with others.



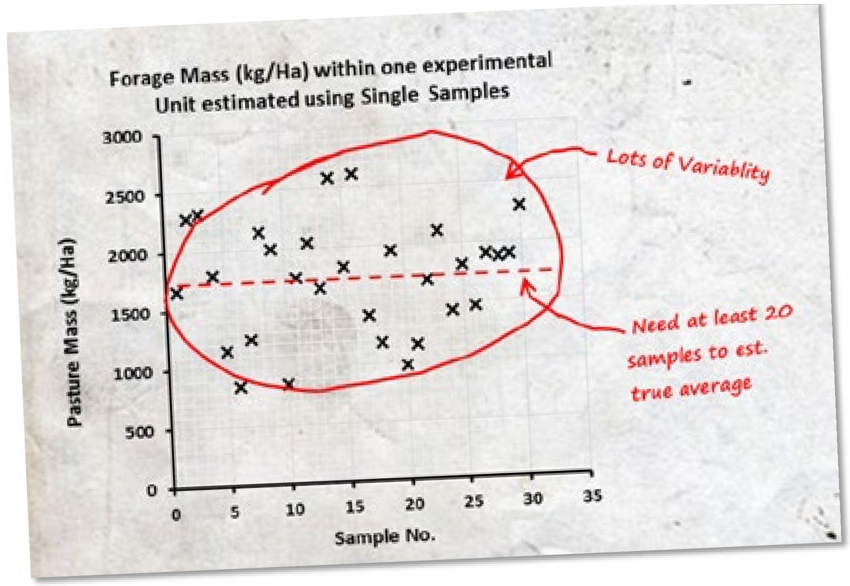
It is useful to draw out a plot map or plan to help visualize the project and keep track of which treatment has been applied where. Make sure that any changes you make in the field are reflected on your map. Be sure to make at least one copy of the plot map and keep it somewhere safe so that you don't lose all your work if you lose your working copy of the map.

Subsample to Increase Precision

When measuring variables like soil nutrient content and forage mass it is important to take a lot of samples. Pastures are "fertilized" and "harvested" by animals; the forage within them is a dynamic, diverse, living community of plants. As a result, the characteristics of the pasture can vary greater within a small area. To overcome the variability, many samples must be taken in order to accurately estimate what the experimental unit is really like. Usually 30 samples are recommended for experimental unit ½ acre or greater in size. For smaller experimental units, 15-20 subsamples would be adequate.

For samples that are shipped to laboratories for analysis, thoroughly mix together at least 20 (30 is best) samples collected from one experimental unit. Then select a portion of aggregated sample to send out for analysis. Always strive for a good, representative sample.

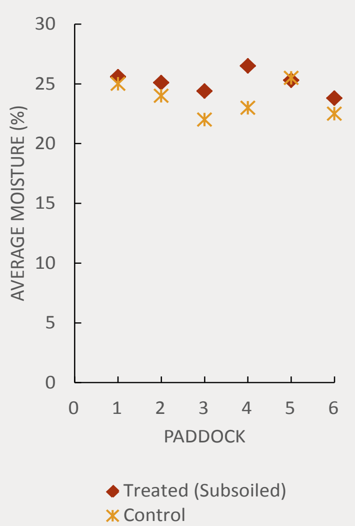
For variables that you are measuring on your farm (soil moisture, forage height, etc) take at least 20 (30 is best) measurements in each experimental unit. Calculate the average of all of the measurements. This new value will be the best estimate of the soil/forage parameter in each experimental unit.



Why Use Statistics?

Although, it might seem easy to simply plot the data and visually dertmine whether or not the treatment had it impact, it is often more complicated.

For example, consider the below plot of average soil moisture readings within six paddock. It appears as if areas that received the treatment (sub-soiling) ***usually*** *had higher soil moisture. However, you cannot be certain, by looking at the results, if this was some coidence or if the treatment truely had an signifiant effect on soil moisture. By using statistics, we can report, with a 95% confidence, that the soilsoiling increased*



STEP 5

ANALYZING THE RESULTS

After you have completed the experiment and obtained all of the results, you will need to analyze the data in order to determine if the treatment had a "statistically significant" effect on the pasture. The goal is to determine, with at least 95% certainty, whatever happened in your paddocks was not a fluke. This important step brings together all of the data, from all of the paddocks, and summarizes it into one simple statement.

There are a couple of different ways to analyze the data. We've outlined two in the following pages. Keep in mind that this method only works for experiments with two treatments. If you have more than two treatments, we suggest you consult a statistician or your local extension agent.

ANALYZING THE DATA BY HAND

The first step is to generate a table with your data for each varaible you measured. You can use only one value for each experimental unit; if you subsampled within the paddock, you will need to caculate the average of each of the individual measurements within the experimental unit.

Arrange the data in three columns. In the first column, list the pairs (usually paddocks). In the second and third column fill in the data from the control and treatment plots, respectily, corasponding to each pair. To caculate the statistical signifiance of the data, following the steps listed below:

Step One: Caculate the differences (d)
Substract the treatment values from the control values in each pairs to caculate the difference (d)

Step Two: Calculate the values for d^2
Square all the values for the difference (d*d)

Step Three: Calculate the value for Σd
Add up all of the values for difference (d).

Step Four: Calculate the value for Σd^2
Add up all the values for d^2 dfd

Paddock	Control	Treatment	Difference (d)	d^2
1	18.4	17.8	0.6	0.36
2	17.1	17.3	-0.2	0.04
3	17.6	19.8	-2.2	4.84
4	18.8	18.1	0.7	0.49
5	16.5	18.1	-1.6	2.56
6	17	19.1	-2.1	4.41
			-4.8	11.98

STEP 1
Control − Treatment = d

STEP 2
$d \times d = d^2$

N = 6

STEP 3
The sum of all the values of d is Σd

STEP 4
The sum of all the values of d^2 is Σd^2

Step Five: Record your value for N

N is equal to your number of pairs pr number of paddocks

Step Six: Calculate the value for t (t-value)

Use the following formula to calculate the t-ratio.

$$t = \frac{\frac{\sum d}{N}}{\sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{N}}{N(N-1)}}}$$

Step 6: Compare your t-value to the critical t-value that corasponding to the number of pairs in your study (N) using the table below.

Number of Pairs	Critical T-Values
4	3.2
5	2.8
6	2.6
7	2.4
8	2.4
>9	2.3

Statistically Significant

In statistics, a result is called statistically significant if it is unlikely to have occurred by chance.

If your t-value is greater than the Critial t-value, you can be 95% confident that the treatment and control are different. If your value is less than the critical t-value, then the treatment (most likely) did not have any impact.

STEP 5

Use the following formula to calculate the t-ratio

$$t = \frac{\frac{\Sigma d}{N}}{\sqrt{\frac{\Sigma d^2 - \frac{(\Sigma d)^2}{N}}{N(N-1)}}}$$

Keep in mind that ...

N = number of pairs of scores

d = difference between matched pairs

$$t = \frac{\frac{-4.8}{6}}{\sqrt{\frac{11.98 - \frac{(-4.8)^2}{6}}{6(6-1)}}} = \frac{-0.8}{\sqrt{\frac{11.98 - 3.84}{30}}} = \frac{-0.8}{\sqrt{0.271}} = 1.536$$

STEP 6

Determine if there is a significant different between the treatment and control.

1.536 is less than 2.6 therefore is is not a significant difference!

The treatment does not appear to impact the field.

ANALYSING THE DATA WITH SPREADSHEET SOFTWARE

Another way to determine if there is a statistically significant different between the control and treated plots is to use Microsoft Excel or other spreadsheet software to run a two-sided, paired t-test. Whenever you collected data on multiple days thoughout the season, you will need to run this statistical analysis for each sampling event and for the entire project.

Step 1: Enter the Data into Excel

To analyze a paired data set, enter the data into a spreadsheet. Organize the data the same manner as pictured in the image below. You will have one column containing all of the data from the "treated" experimental units and one column with all the data from control experimental units. (Mostly likely these values will be the averages from all of you subsamples.) Each row will contain data from a single paddock/pair collected on a single date.

1	Paddock	Date	Subsoiled	Control
2	1	23-Jun	25.6	25
3	2	23-Jun	25.1	24
4	3	23-Jun	24.4	22
5	4	23-Jun	26.5	23
6	5	23-Jun	25.3	25.5
7	6	23-Jun	23.8	22.5

Formula meaning?

TTEST

Run a T-test

C2:C7

An array containing all of the data from treated experimental units.

D2:D7

An array containing all of the data from control experimental units.

2

Two Side T-test

1

Paired Data

Step 2: Run a Paired T-test to dermine the P-Value

The aim of these steps is to calculate the probability that the treatment did not have an effect on the measurable variable on a given date.

In any empty cell, type:

```
=TTEST(C2:C7,D2:D7,2,1)
```

Notice how "C2:C7" is an array encompassing all the celled from C2 down to C19. You will want to change this to encompass all of the call cells from in your treatment column. Similarly, you will need to adjust "D2:D7" to encompass all of the cells in your control column. When finished, click **`Enter`**

The number displayed is the probability that the treatment did not have an effect. In the case of out example, there was a 4.31% change that the treatment and the control were the same. Any time this value is less 5% (0.05), most agricultural researchers will assume that that the treatment and the control are different. Therefore, we can conclude from our example that the treatment (in this case subsoiling) had a significant effect on soil moisture.

	A	B	C	D	E	F
1	Paddock	Date	Subsoiled	Control		P-Value
2	1	23-Jun	25.6	25		0.04312519
3	2	23-Jun	25.1	24		
4	3	23-Jun	24.4	22		
5	4	23-Jun	26.5	23		=TTEST(C2:C7,D2:D7,2,1)
6	5	23-Jun	25.3	25.5		
7	6	23-Jun	23.8	22.5		

Probability that the treatment did NOT have an effect on a specific day

You will want to "play" around with the data to draw more conclusions. Use the spreadsheet software to determine what the average difference was between the control and treated plot. You can also make graphs and charts to summarize the data.

STEP SIX
WHAT TO DO WITH YOUR RESULTS

If you do get a significant difference between your treatment and your untreated control, what does it really mean? If your treatment yielded 20% more pasture mass than the untreated control, will that really result in 20% more available pasture for your animals? Using your results, you may now decide to expand your test to a larger pasture area. One approach would be to treat an area that normally (based on past records) gives you about four days' worth of grazing. Will the treatment now give you five days of grazing in that area?

STEP SEVEN
SHARE YOUR RESULTS

After you've completed your research and analyzed the results, put aside some time to share your results with other researchers and farmers. It doesn't matter if your results were positive or negative – other farmers and researchers will want to learn from all your hard work.

Try to target your research toward the stakeholders that will be most interested in the results. Extend your outreach campaign beyond the merely local farmer in order find the widest possible appropriate audience.

There are many different ways to spread your message. Below are some common examples. Don't be afraid to get creative and branch out!

Host an field day, on-farm demonstration, or workshop
Contact your local extension agency. They may be able to help you plan and advertise for the event.

Present at a conferences
Contact the event organizers and ask to present a presentation on your research. There are a many grazing and NOFA conferences being conducted all over the country.

Put together a factsheet or brochure
Contact your local extension agency. There is a good chance they will post your factsheet online or display it upcoming field days and workshops.

Write an article for local newsletter
There are many newsletters oriented toward farmers. Consider contacting the editor and submitting a short article.