Nutrient Management for Grazers

Webinar #1

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PRO DAIRY Education & Applied Research

NMSP Nutrient Management Spear Program

Cornell University Founded A.D. 1865

Cornell CALS College of Agriculture and Life Sciences

Nutrient Management for Pastures

PASTURE is a CROP!

Why is it important?

- Maximize productivity, reduce losses
- Nutrients are required for forage quality (not just quantity)
- Required for Organic certification, local/state rules, etc.
- Soil health requires managing fertility…we shouldn't be mining our soil's resources
- Low yielding systems are 'leaky'
- Profitability is required for sustainability
- Good grazing management is also good nutrient management

Nutrient Management for Pastures

Nutrient Management for Pastures

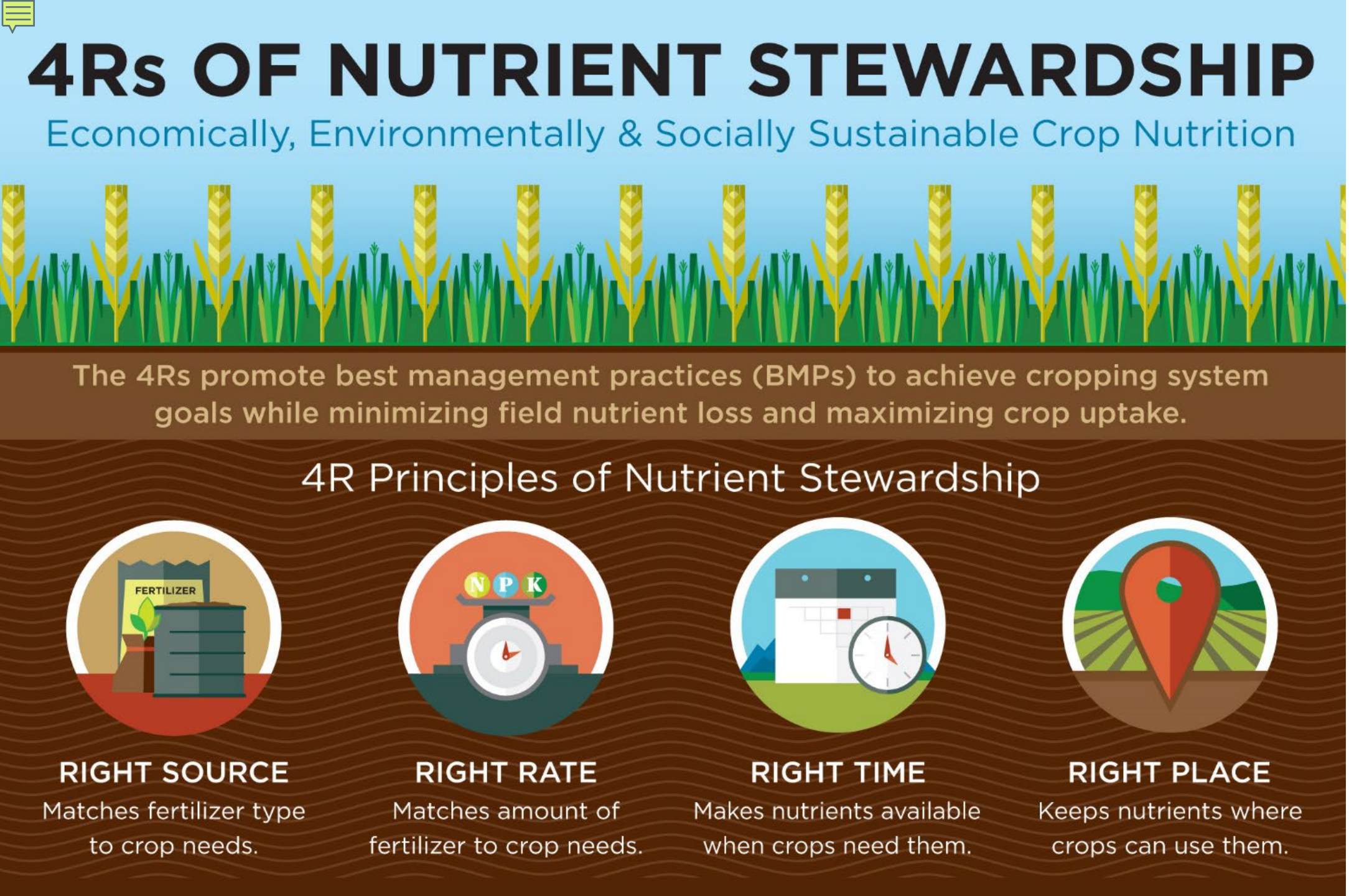
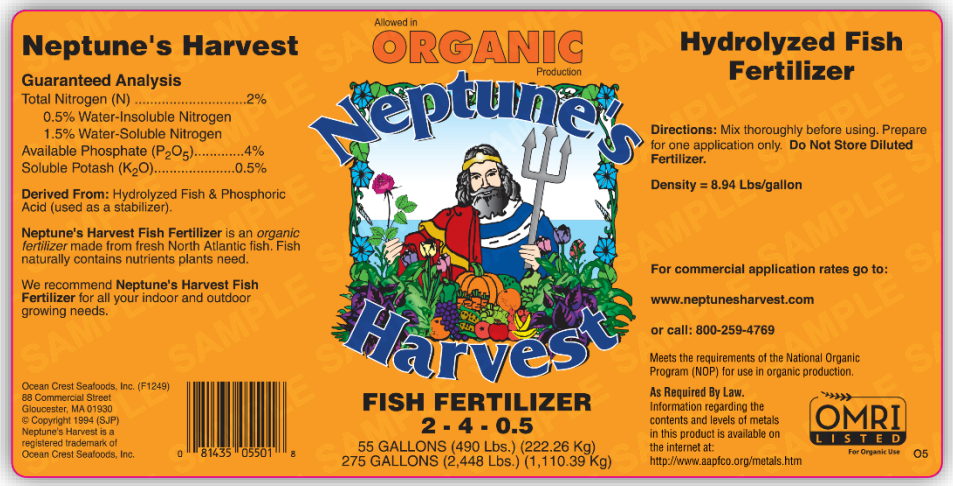


Image courtesy of The Fertilizer Institute
www.nutrientstewardship.com

Right Source

RIGHT SOURCE

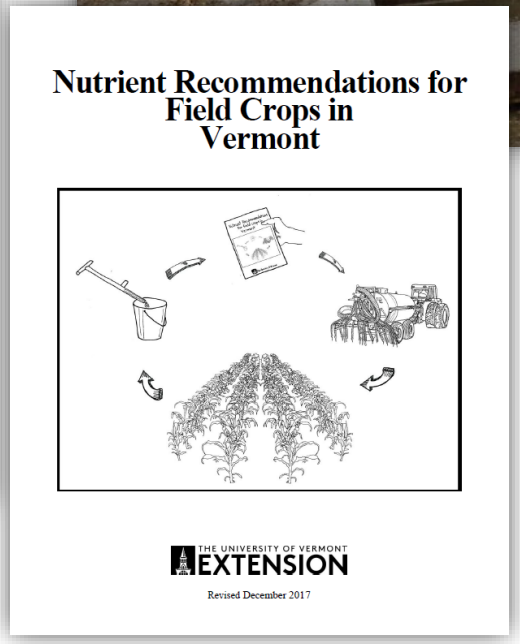
Matches fertilizer type to crop needs.



Right Rate

RIGHT RATE

Matches amount of fertilizer type crop needs.



Nutrient Recommendations for Field Crops in Vermont

THE UNIVERSITY OF VERMONT EXTENSION

Revised December 2017

Right Time

RIGHT TIME

Makes nutrients available when crops needs them.

=

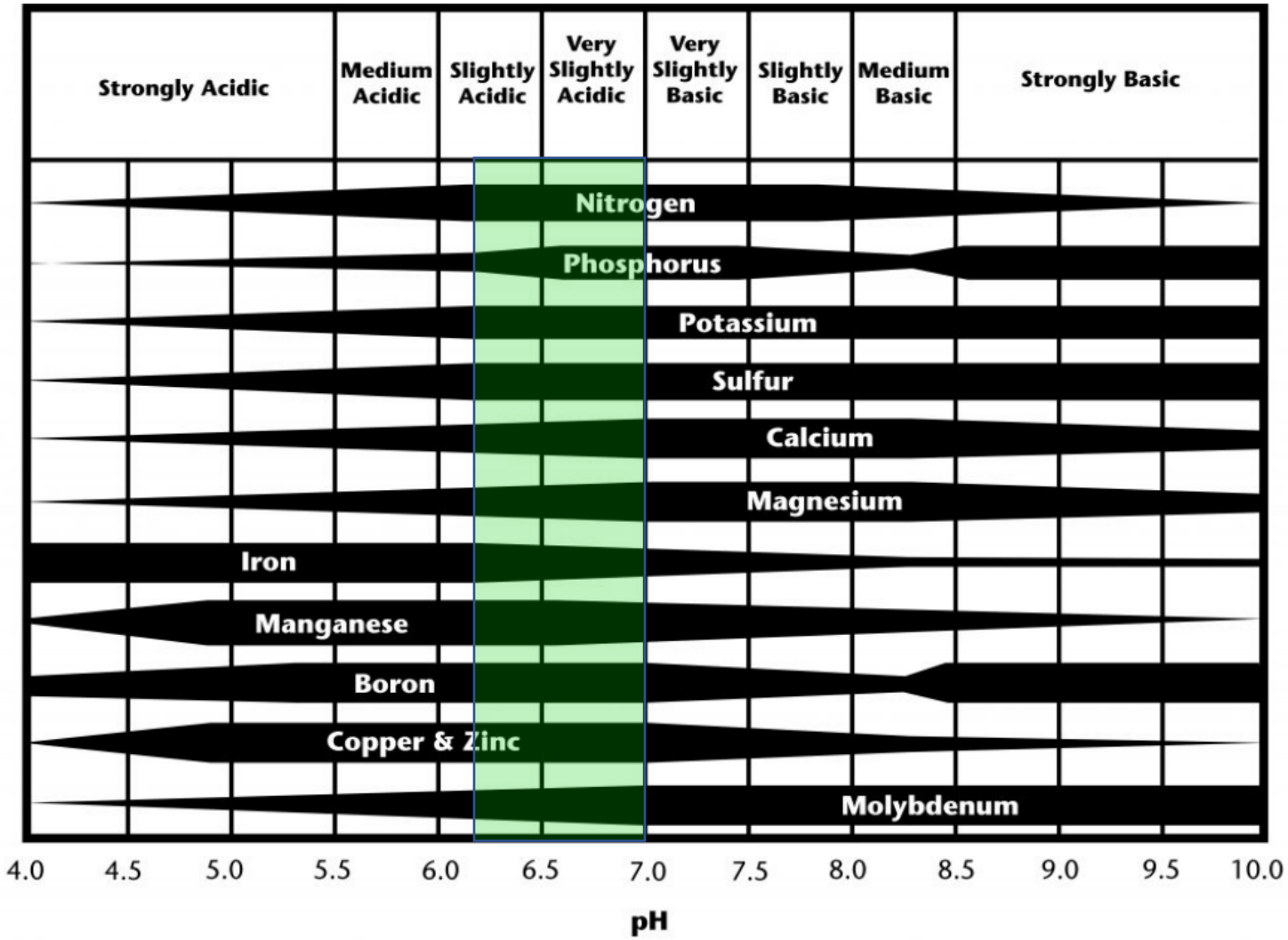
Right Place

RIGHT PLACE

Keep nutrients where crops can use them.

Soil Fertility - Lime! Lime! Lime!

- **pH management helps with nutrient management**
- **To know when to apply lime, soil test**



Soil Fertility - Nitrogen

Nitrogen

- 50% legume = no additional N (but need to manage other factors)
- Split applications (50-75)
- Only fertilize what you can harvest/graze…don’t get ahead of yourself and waste it.
- Can impact quality – not just quantity
- Maximize your manure nitrogen!

Soil Fertility – Soil Testing and P & K

Soil Fertility – Soil Testing, P & K Fertilization

Table 2.10.1 from 2022 Cornell Guide for Integrated Field Crop Management

Soil Management Group	Phosphorus Soil Test Value[2]					Potassium Soil Test Value					Magnesium Soil Test Value[3]				
	Very Low	*Low*	*Medium*	*High*	*Very High*	*Very Low*	*Low*	*Medium*	*High*	*Very High*	*Very Low*	*Low*	*Medium*	*High*	*Very High*
I	<1	1-3	4-8	9-39	40+	<35	35-64	65-94	95-149	150+	<20	20-65	66-100	101-199	200+
II	<1	1-3	4-8	9-39	40+	<40	40-69	70-99	100-164	165+	<20	20-65	66-100	101-199	200+
III	<1	1-3	4-8	9-39	40+	<45	45-79	80-119	120-199	200+	<20	20-65	66-100	101-199	200+
IV	<1	1-3	4-8	9-39	40+	<55	55-99	100-149	150-239	240+	<20	20-65	66-100	101-199	200+
V	<1	1-3	4-8	9-39	40+	<60	60-114	115-164	165-269	270+	<20	20-65	66-100	101-199	200+

[1]Values are in pounds per acre of soil test extractable nutrient using the Cornell Morgan soil test. Using a different test will add uncertainty to the interpretations and recommendations.

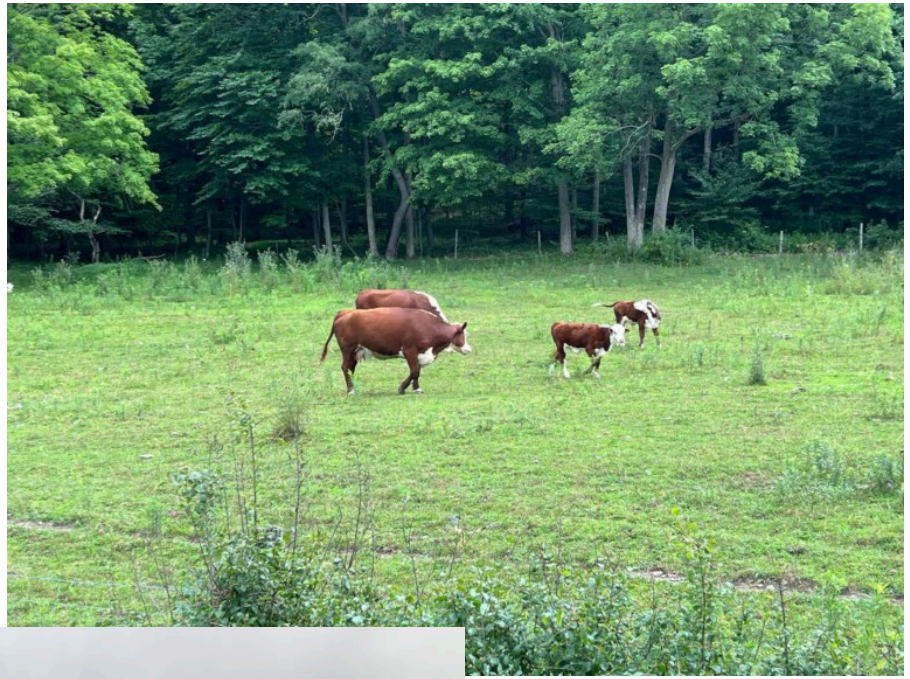
[2]Soil test phosphorus values differ for winter grains. High is 9-20 lbs P/acre and Very High is 20+ lbs P/acre.

[3]Magnesium levels shown are for all field crops except birdsfoot trefoil and soybeans. For these two crops, double the values shown above.

A word about yield

Maximizing pasture (and hay field) yields is an important strategy for…

- Minimizing feed imports
- Increasing efficiency
- Minimizing your carbon footprint
- Reducing environmental losses
- Maximizing profitability



Rich Taber / CCE Chenango

Maximizing Home Grown Nutrients

- Maximize Yield
- Minimize undigestible fiber
- Optimize energy
- For stored forages and pastures!

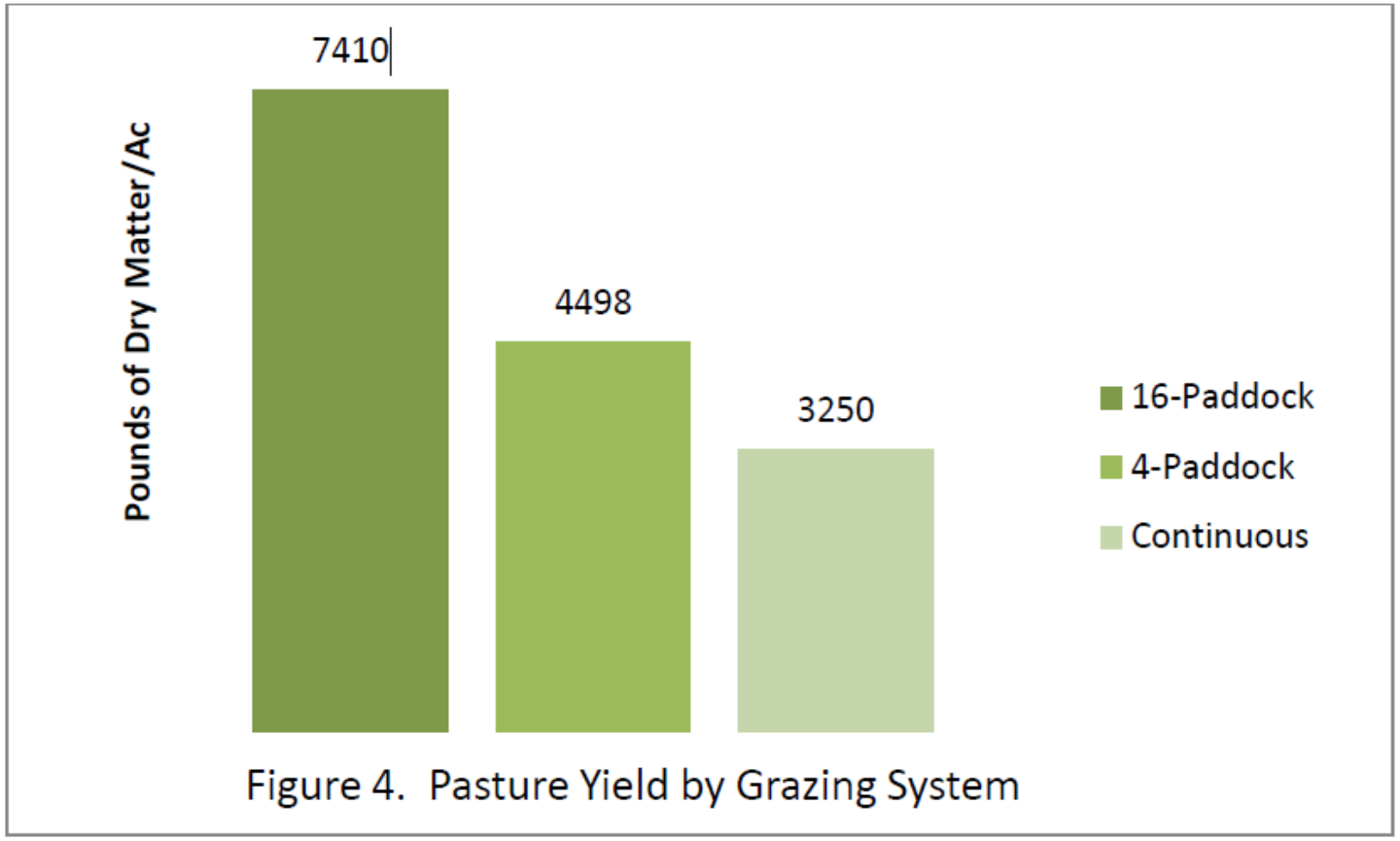


Figure 4. Pasture Yield by Grazing System

Maximizing Pasture Yields

Timing is everything

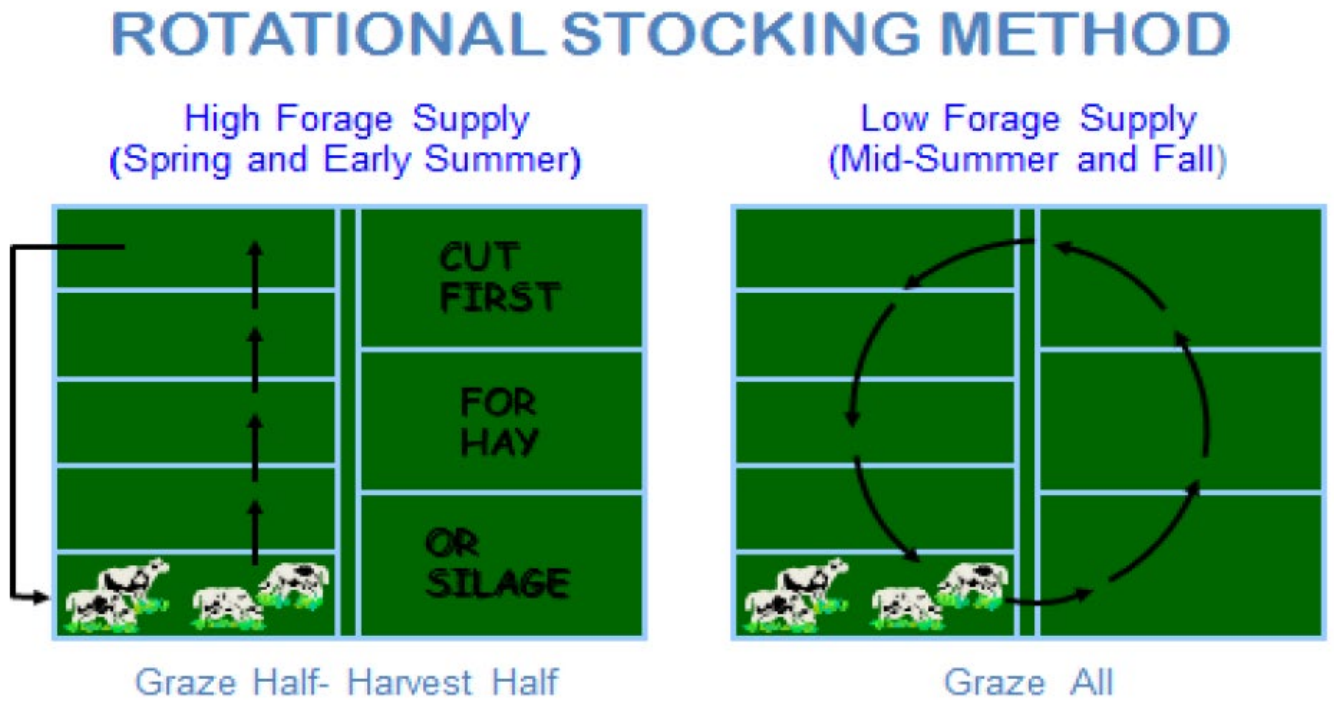
Pastures

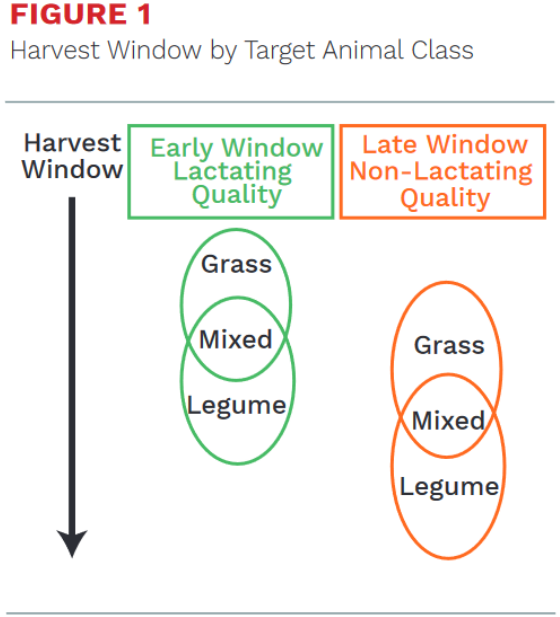
- Timing of grazing AND timing of rest/recovery
- Don’t start too early
- Don’t go too late

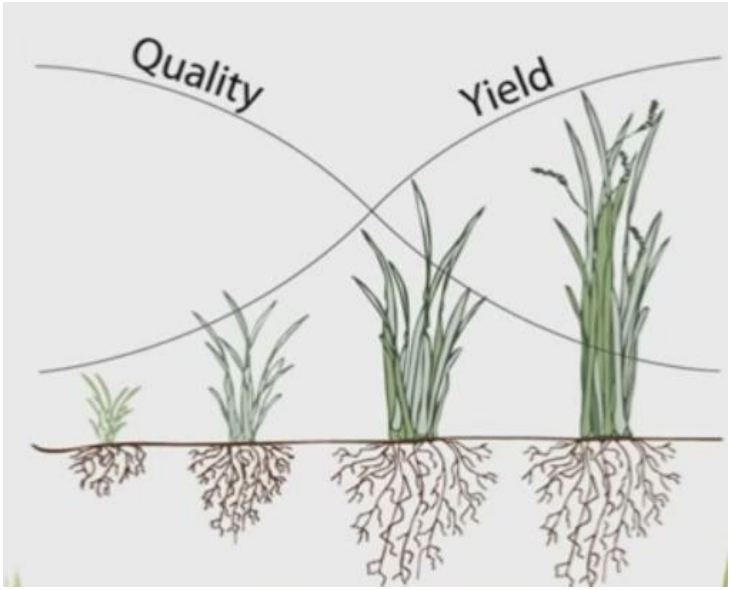
Timing of forage harvest

- Maturity
- Field conditions

Dynamic harvest schedules



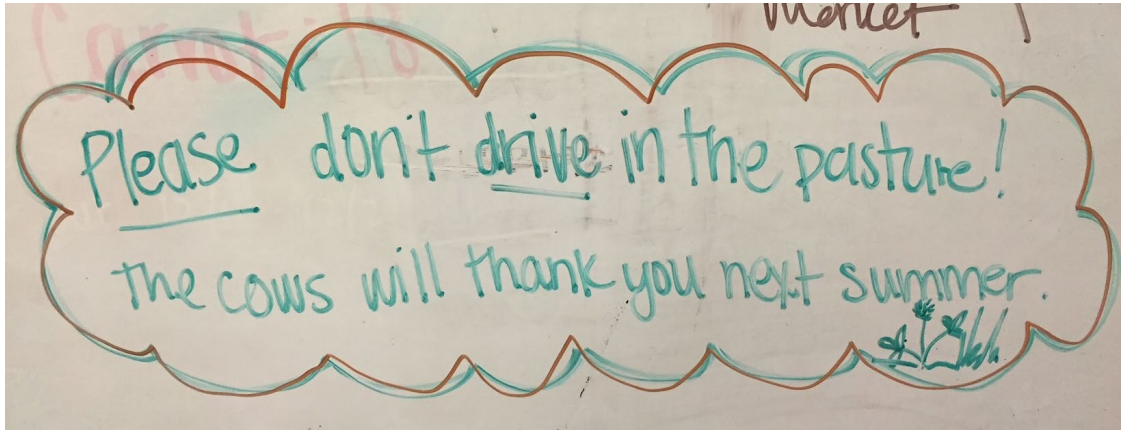




Maximizing Pasture Yield & Quality

Anti-Quality Factors

- Species (wrong species or right species, wrong situation)
- Reduced intake (over mature, thorns, etc.)
- Make animals ill/death (toxicity)
- Palatability vs. preference



DON'T LOSE IT IN THE BUNK/BALE

Manage stored feeds to minimize shrink and maximize quality

- Good fermentation or drying
- Good storage conditions
- Good feedout management

Managing Nutrient Applications

Soil Fertility

- Manure – let's manage it well

Cornell University Cooperative Extension

Agronomy Fact Sheet Series

Fact Sheet #18

Calibrating Manure Spreaders

Introduction

regular measuring tape or acreage measuring wheel. The length can also be determined using a GPS unit. Length times the width divided by 43,560 (square feet per acre) equals the total acreage covered.

Step 3: Calculate rate.

To determine the application rate in pounds per acre, divide the manure weight (step 1) by the application acreage (step 2). Divide this by the application rate in tons per acre.

Step 2: Determine application area.

Measure the width and length of the applica pattern. The width is easily measured with a

College of Agriculture and

Field Crops Extension

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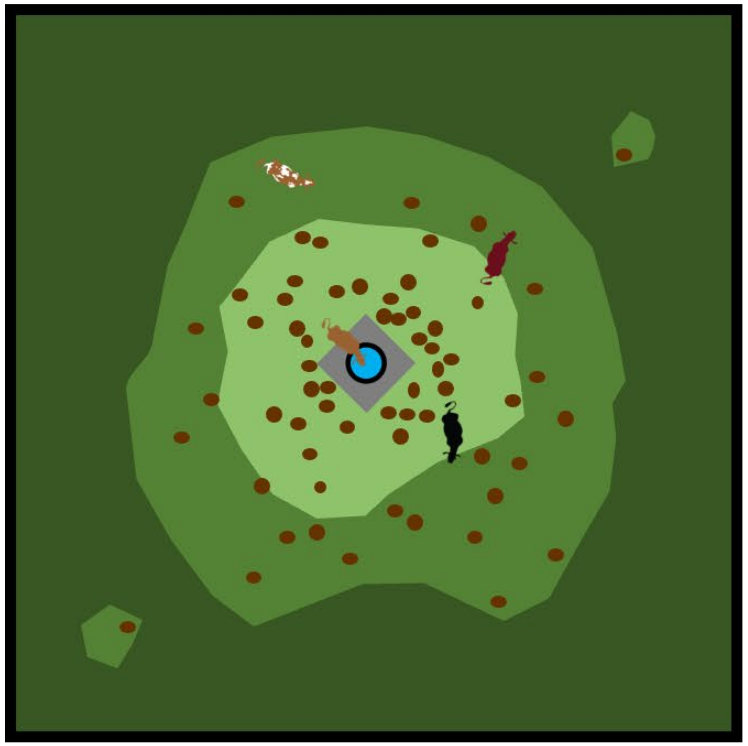
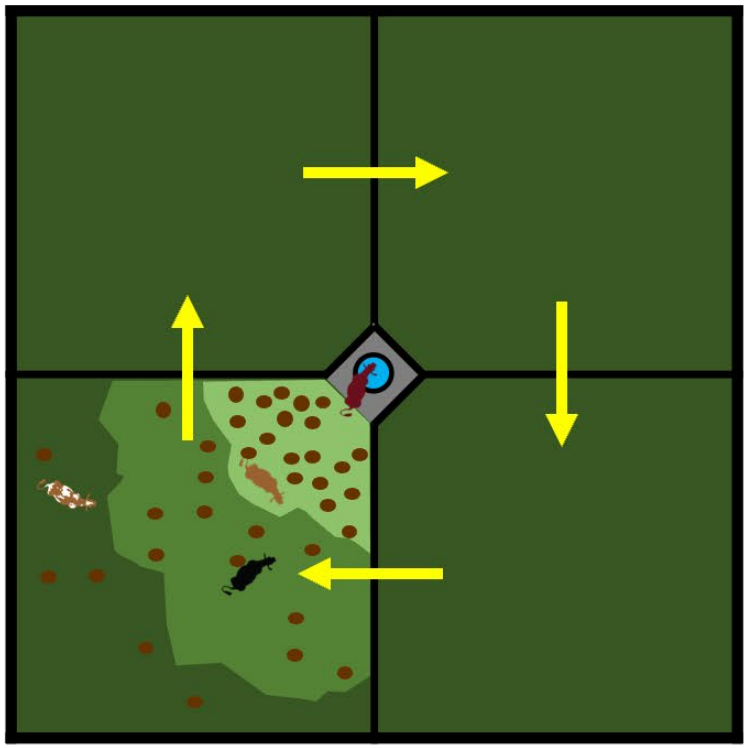
Managing Nutrient Applications

Grazing Management is also Crop & Nutrient Management

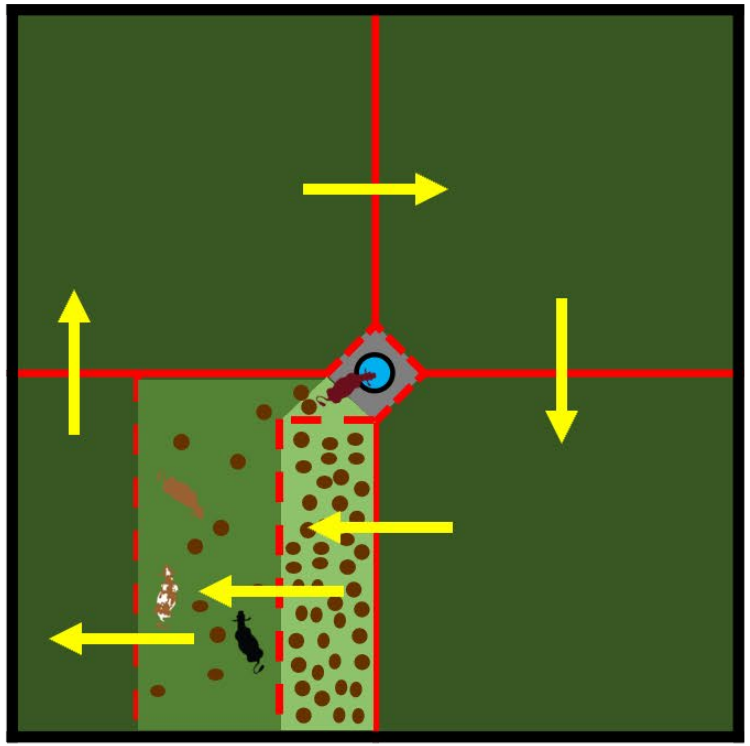
Continuous Grazing



Conventional Rotational Grazing

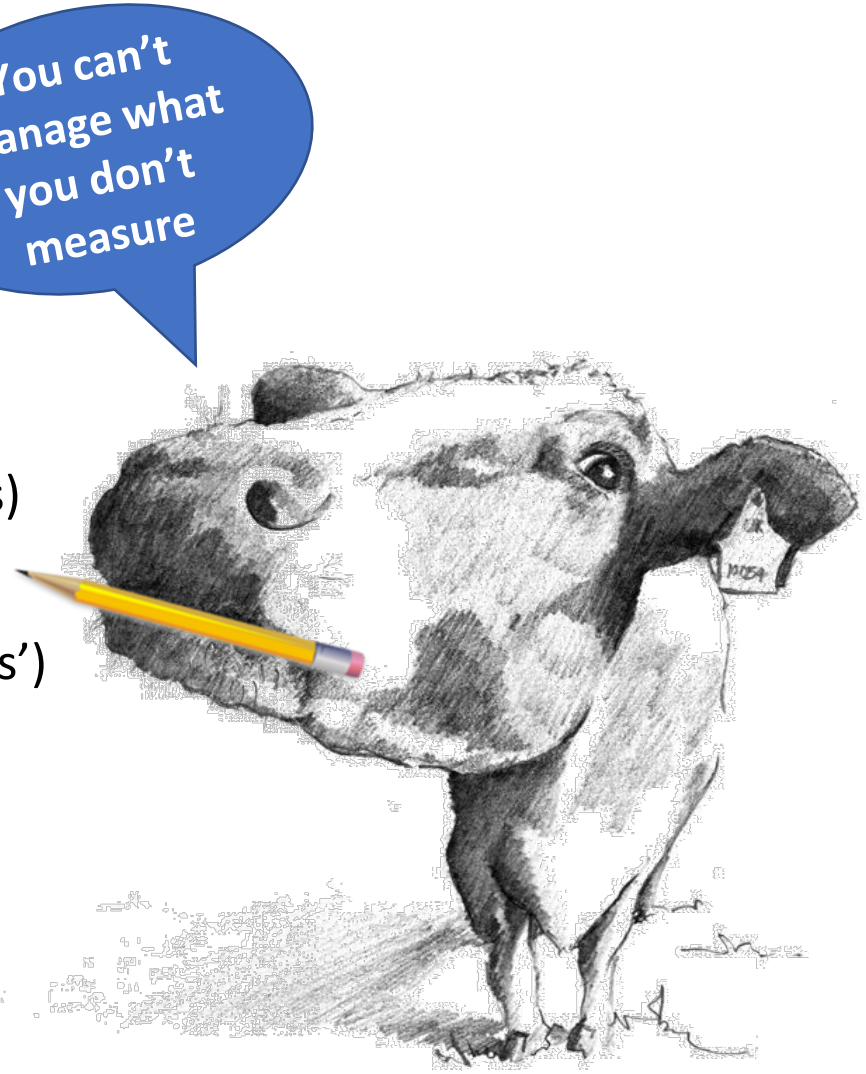


Mgt. Intensive Grazing



Records/Information needed for Nutrient Management

- ✓ **Basic info**
  - Maps, acres, soil types, environmental concerns
  - Soil tests, manure tests, animal information
- ✓ **Yields???**
  - Amount of forage harvested…by cows and people
  - How do you estimate (grazing records, pasture stick, others)
- ✓ **Manure volume & nutrient applications**
  - Accounting for grazing manure (animal groups as ‘spreaders’)
  - Calibrating spreaders (manure or otherwise)
- ✓ **Grazing Charts**
  - Using them as record keeping tools too!



Basic Info

Information	Where? How?	How often?
Maps/soil types/environmental concerns	NRCS SWCD Extension Online	Initial Whenever landbase changes
Soil tests	You SWCD	Every 3 years (or more frequent if tracking something or rotating crops)
Manure tests	YOU	Annually – or whenever you spread
Fertilizer Analysis	Supplier	Whenever purchasing
Animal Info (#s, weights, groupings)	YOU	ongoing
Imported Feeds + analysis	Supplier or you	Whenever purchasing

Basic Info

Information	Tools
Maps/soil types/environmental concerns	Web Soil Survey: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm
Soil tests	Use your Landgrant recommended soil analysis and send to a certified lab.
Manure tests	Certified Lab Book Values: https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/NutrientRec_BR1390.3_Sept2020.pdf (Vermont, pg. 20) http://nmsp.cals.cornell.edu/publications/factsheets/factsheet122.pdf (Cornell)
Fertilizer Analysis	https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/NutrientRec_BR1390.3_Sept2020.pdf (pg. 24)
Animal Info (#s, weights, groupings)	Your records, weight tapes, scales, estimates
Imported Feeds + analysis	Your records, invoices, analysis from source

Yields

How to measure yields

Harvested Crops

- Yield checks
- Weigh bales/loads

Pastures

- Clipping
- Falling Plate
- Pasture Stick
- Calculating based on DMI 3%

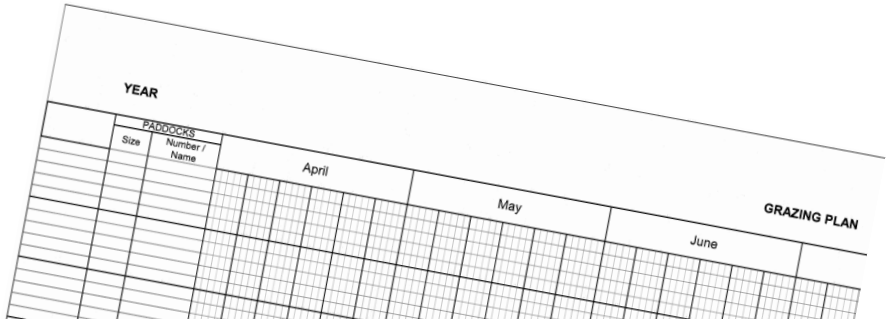
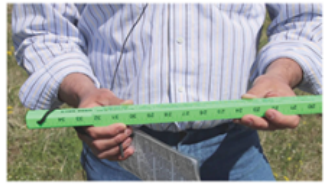


Figure 1: Methods of Pasture Dry Matter Measurement			
	Clipping Samples	Falling Pasture Plate	Pasture Stick
			
Cost	$5.00-$10.00	$20.00-$40.00	$12.00
Accuracy	+++	++	+
Ease of Use	+	++	+++
Additional Information	Very accurate but only practical to do a few times/year	Professionally manufactured plate meters available for extra cost	Erik's choice for ease of use and consistent DMI measurement

Sources: Image 1.) Ohio State University: http://ohioline.osu.edu/factsheet/11-HCS-868 Image 2.) West Virginia University Extension Service: https://www.wvu.edu/~agexten/pubnwsltr/TRIM/5022.htm Image 3.) South Dakota State University: https://i.ytimg.com/vi/c9CylrlqVvI/maxresdefault.jpg

https://ohioline.osu.edu/factsheet/11-HCS-868

Yields

Pastures – Clipping

- Sample a known area by clipping (at typical grazing height). Usually 1 – 2 square feet
- dry it down (microwave will work)
- Weigh the dried sample and then convert to pounds DM/acre

0.05 lbs DM/sq ft x 43,560 = 2,178 lbs DM/acre

- Can be time consuming, but a good way to start and to calibrate other methods
- *Should* do multiple samples/paddock

Yields

Pastures -Pasture Stick

- Measure height
- Measure stand density to get estimate of pounds per inch
- Multiply pounds/inch x # grazing inches available

200 lbs DM/inch x 12 inches available = 2,400 lbs DM/acre

- *Should* do multiple samples/paddock

https://extension.sdstate.edu/using-grazing-stick-assess-pasture-forage

https://youtu.be/bSYflqjP6B0

Yields

Pastures - Calculating based on DMI

- Animal Wgt x # animals in group x percent intake = Pounds forage/day

15 yearlings x 850 lbs x .03 = 383 lbs DM/day

- They grazed that 0.5 acre paddock for 3 days (and did not run out of forage and we left a good residual)

3 x 383 = 1,149 lbs DM / 0.5 acres = 2,300 lbs DM/ac

For groups with multiple animal types/sizes, calculate for each 'type' and add together

This is also imperative for PLANNING your grazing as well…how much is out there and how long should a group of animals be out there?

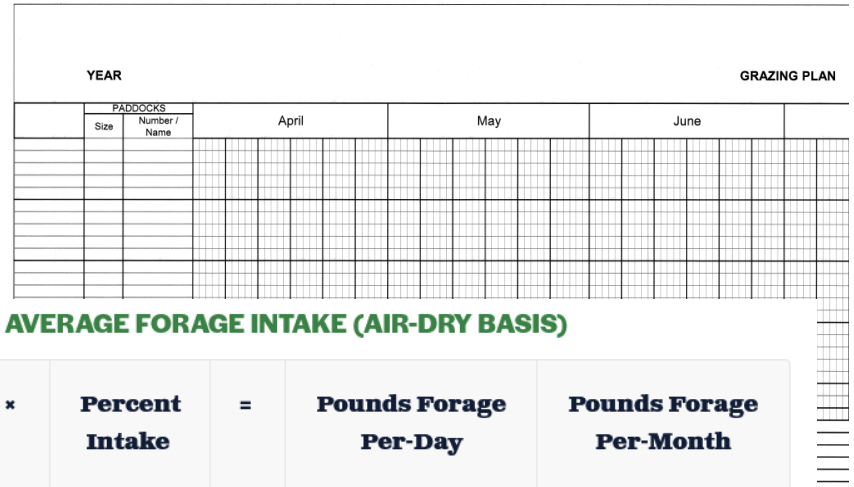


TABLE 3. AVERAGE FORAGE INTAKE (AIR-DRY BASIS)

Species	Animal Weight	×	Percent Intake	=	Pounds Forage Per-Day	Pounds Forage Per-Month
Sheep	130	×	.037	=	4.8	146
Sheep	200	×	.037	=	7.4	225
Yearling	650	×	.03	=	19.5	593
Yearling	850	×	.03	=	25.5	775
Cow	1,000	×	.03	=	30	912
Cow	1,200	×	.03	=	36	1,094
Cow	1,400	×	.03	=	42	1,277
Cow	1,600	×	.03	=	48	1,459

Manure Inventory & Nutrient Applications

Manure Volumes

- Amount stored during winter
- Amount ‘spread’ on pastures by grazing animals

Nutrient Applications

- Amount spread/day/grazing unit
- Calibrate manure spreader?

Tools

- grazing ‘unit’ manure estimations - UMass
- Vermont Manure Screening Tool
- How to calibrate a manure spreader

Manure Inventory

Manure Volumes

Amount stored during winter

Number of Animals x Average Weight of Animal (lb) ÷ 1000 (animal unit) x Daily Manure Prod. x Manure Collection Period (days) + Estimated Percent of Bedding in Manure.

10 sheep x 200 lbs /1000 = 2 AUE

2 x 40 lbs/day x 100 days in barn = 8,000 lbs manure collected

8,000 x 1.05 (5% bedding) = 8,400 lbs/2000 = 4.2 tons

Amount 'spread' on pastures by grazing animals

10 sheep x 200 lbs /1000 = 2 AUE

2 x 40 lbs/day x 1 grazing day = 80 lbs/day

80 x 260 days 'out' = 20,800 lbs/2000 = 10.5 tons

Table 1. Average daily manure production and nutrient content of manure. Values are based on animal unit (1000 lb) and do not include bedding*.

ANIMAL TYPE	DAILY PRODUCTION	ANALYSIS UNITS	N	P_2O_5	K_2O
Dairy cow: lactating (liquid)	13 gal	lb/1000gal	28	13	25
Dairy cow: lactating (solid)	106 lb	lb/ton	10	4	8
Dairy cow: dry	82 lb	lb/ton	9	3	7
Dairy cow: calf and heifer	87 lb	lb/ton	7	2	7
Beef cattle: cow and calf	60 lb	lb/ton	11	7	10
Beef cattle: steer	75 lb	lb/ton	14	5	8
Beef cattle: veal	5 gal	lb/1000gal	36	27	55
Swine: gestation	4 gal	lb/1000gal	30	35	15
Swine: lactation	10 gal	lb/1000gal	25	20	15
Swine: nursery	14 gal	lb/1000gal	40	40	25
Swine: grow-finish	11 gal	lb/1000gal	50	55	25
Swine: farrow to feeder	7 gal	lb/1000gal	40	35	15
Sheep	40 lb	lb/ton	23	8	20
Horse	45 lb	lb/ton	12	5	9

** Adapted from: The agronomic guide 2002. College of Agricultural Sciences, Penn State University.*

Nutrients in stored manure
4.2 x 23 = 97 lbs N
4.2 x 8 = 34 lbs P2O5
4.2 x 20 = 84 lbs K2O

Nutrients in grazing manure
10.5 x 23 = 242 lbs N
10.5 x 8 = 84 lbs P2O5
10.5 x 20 = 210 lbs K2O

Manure Applications

Estimating Manure application

Amount 'spread' on pastures by grazing animals per day

10 sheep x 200 lbs /1000 = 2 AUE

2 x 40 lbs/day x 1 grazing day = 80 lbs/day

80/2000 = .04 tons/day

.04 x 23 = 1 lbs N
.04 x 8 = 0.3 lbs P2O5
.04 x 20 = 0.8 lbs K2O

Table 1. Average daily manure production and nutrient content of manure. Values are based on animal unit (1000 lb) and do not include bedding*.

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Beef cattle: steer	75 lb	lb/ton	14	5	8
Beef cattle: veal	5 gal	lb/1000gal	36	27	55
Swine: gestation	4 gal	lb/1000gal	30	35	15
Swine: lactation	10 gal	lb/1000gal	25	20	15
Swine: nursery	14 gal	lb/1000gal	40	40	25
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** Adapted from: The agronomic guide 2002. College of Agricultural Sciences, Penn State University.*

Estimating Manure application

Calibrating spreaders

- weight loaded - weight empty = load size
- Load size (lbs) ÷ Area covered by load (sq. feet) = (lbs/sq feet x 43,650) ÷ 2000 = tons/acre
- Or count number of loads, multiply by load size and divide by total field acres

23,850 lbs – 11,150 lbs = 12,700 lbs

36’ x 515’ = 18,540 sq feet

(12,700/18,540) x 43,560 ÷ 2000 = 14.9 tons/acre

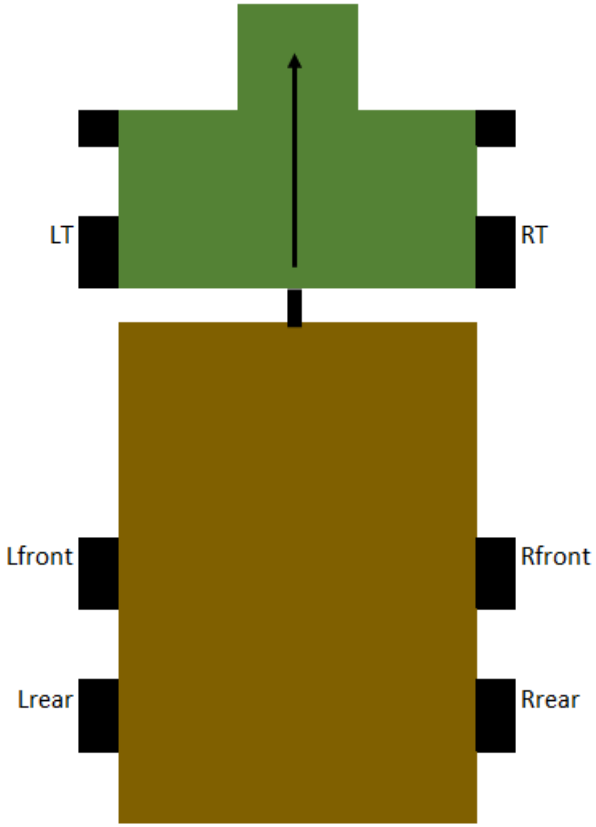
12,700 lbs = 6.35 tons

6.35 x 35 loads = 35*6.35 = 222.25 tons/15 acres = 14.8 tons/acre

Estimating Manure application

THE UNIVERSITY OF VERMONT EXTENSION

Farm: ***Farmstead*** **TA:** Kirsten Workman/
Crop Year 2021 **Calibration Date:** 11/9/2020
Manure Type dairy-solid **Spreader model:** H & S 310



Axle	TARE	aged compost Loaded 1	this year's manure Loaded 2
LT	3700	5000	4500
RT	3500	4650	4400
Lfront	900	3500	3150
Lrear	900	4000	3100
Rfront	1050	3100	3000
Rrear	1100	3600	3500
Total Weight	11150	23850	21650
Net Weight (lbs.)		12700	10500
Net Weight (tons)		**6.35**	**5.25**
spreading rate (tons/acre):		*14.9*	*12.3*

AREA COVERED	
WIDTH	36
LENGTH	515
area coverd (sq. ft.)	18540
area coverd (acres)	0.42562

Spreading Notes:
area covered was measured in field
3 passes with tractor (including overlap)
15-16 clicks in 3rd Gear

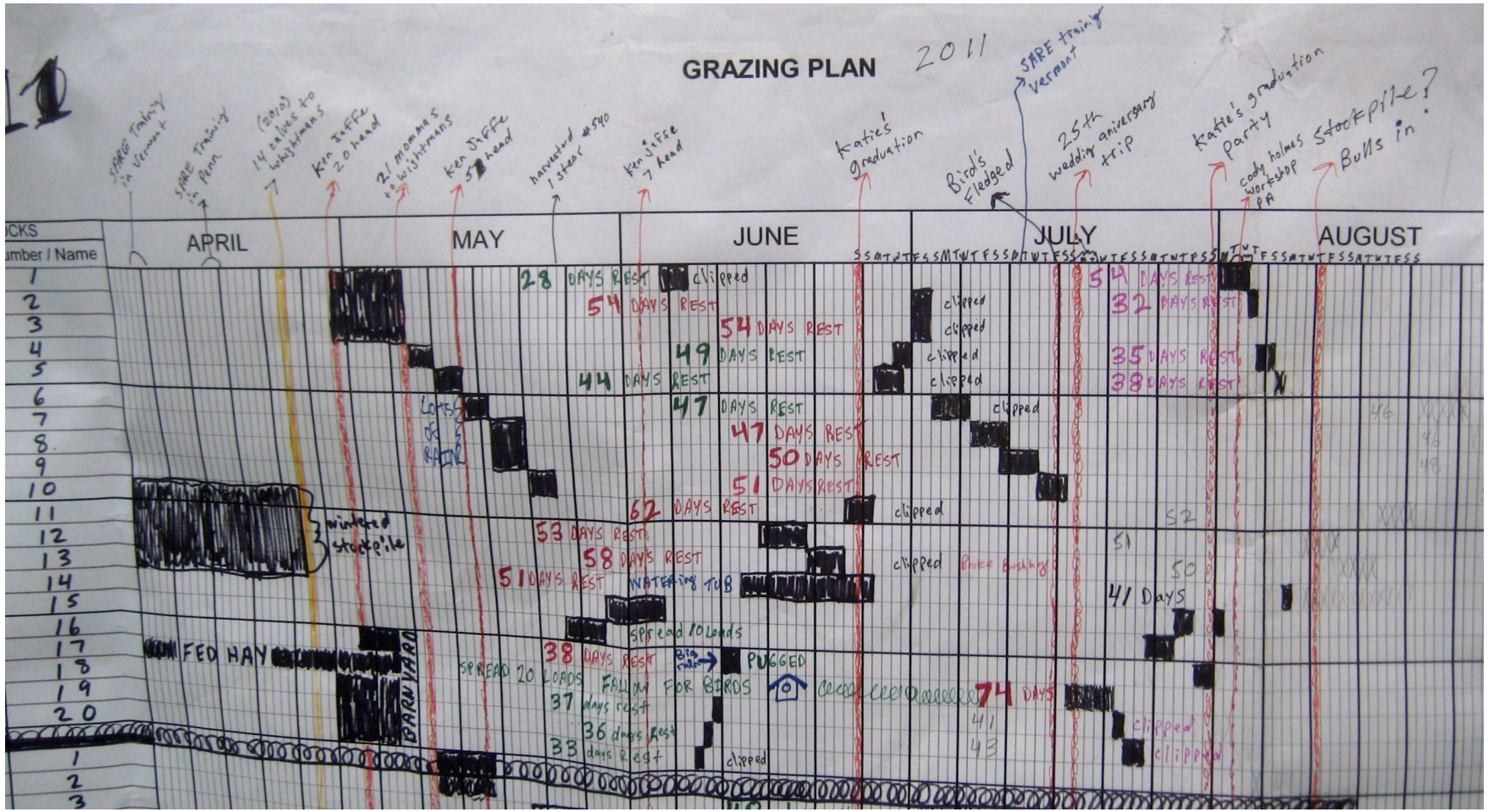
**Manure samples were collected at the time of calibration*

23,850 lbs – 11,150 lbs = 12,700 lbs

36’ x 515’ = 18,540 sq feet

(12,700/18,540) x 43,560 ÷ 2000 = 14.9 tons/acre

Grazing Charts as Record Keeping Tools



YEAR **GRAZING PLAN**

	PADDOCKS		April	May	June	July
	Size	Number / Name				
		RAINFALL/ in				
		SNOW/ in				
Daily Temps						

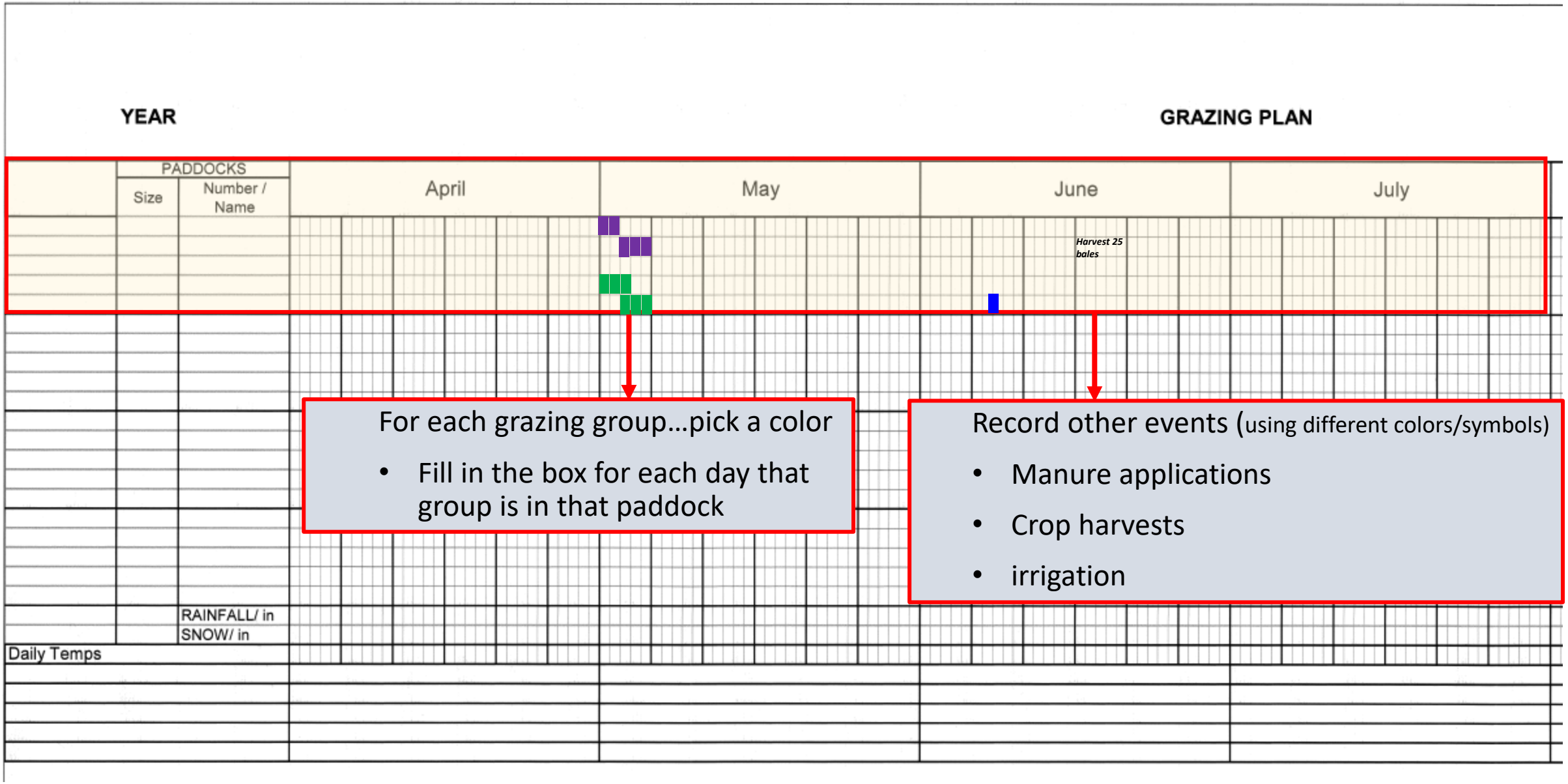
YEAR

GRAZING PLAN

	PADDOCKS		April	May	June	July
	Size	Number / Name				
		RAINFALL/ in				
		SNOW/ in				
Daily Temps						

Write the name of each grazing unit and it's size

- Pasture
- Paddock
- However you manage/rotate


YEAR
GRAZING PLAN
PADDOCKS
Size
Number / Name
April
May
June
July
Harvest 25 bales
RAINFALL/ in
SNOW/ in
Daily Temps
For each grazing group…pick a color
• Fill in the box for each day that group is in that paddock
Record other events (using different colors/symbols)
• Manure applications
• Crop harvests
• irrigation

YEAR

GRAZING PLAN

	PADDOCKS		April	May	June	July
	Size	Number / Name				
		RAINFALL/ in				
		SNOW/ in				
Daily Temps						

Record weather

- Rainfall
- Snow
- Temperatures
- other

YEAR **GRAZING PLAN**

	PADDOCKS		April	May	June	July
	Size	Number / Name				
		RAINFALL/ in				
		SNOW/ in				
Daily Temps						

Record other monthly events

- Notes
- Comments
- observations

Breakout – Resources for NM Records

- Grazing Chart – contact Troy Bishopp (the Grass Whisperer) or your local SWCD/Extension office.
- Managing Pasture as A Crop (D.Emmick) https://blog.uvm.edu/cvcrops/files/2012/10/Managing-Pasture-as-a-Crop.pdf
- Land grant university fertility guidance (refer to your local LGU)
- Using a grazing stick:

  https://youtu.be/bSYflqjP6B0 ;

  https://extension.sdstate.edu/using-grazing-stick-assess-pasture-forage
- Measuring pasture dry matter yields:

  https://ohioline.osu.edu/factsheet/11-HCS-868
- Calculating manure production:

  https://ag.umass.edu/crops-dairy-livestock-equine/fact-sheets/manure-inventory
- Calibrating manure spreaders: https://www.uvm.edu/sites/default/files/Agriculture/CVCROPS/ManureCalibration.pdf ; http://nmsp.cals.cornell.edu/publications/factsheets/factsheet18.pdf

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Thoughts?
Questions?

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