Managing Wet Meadows

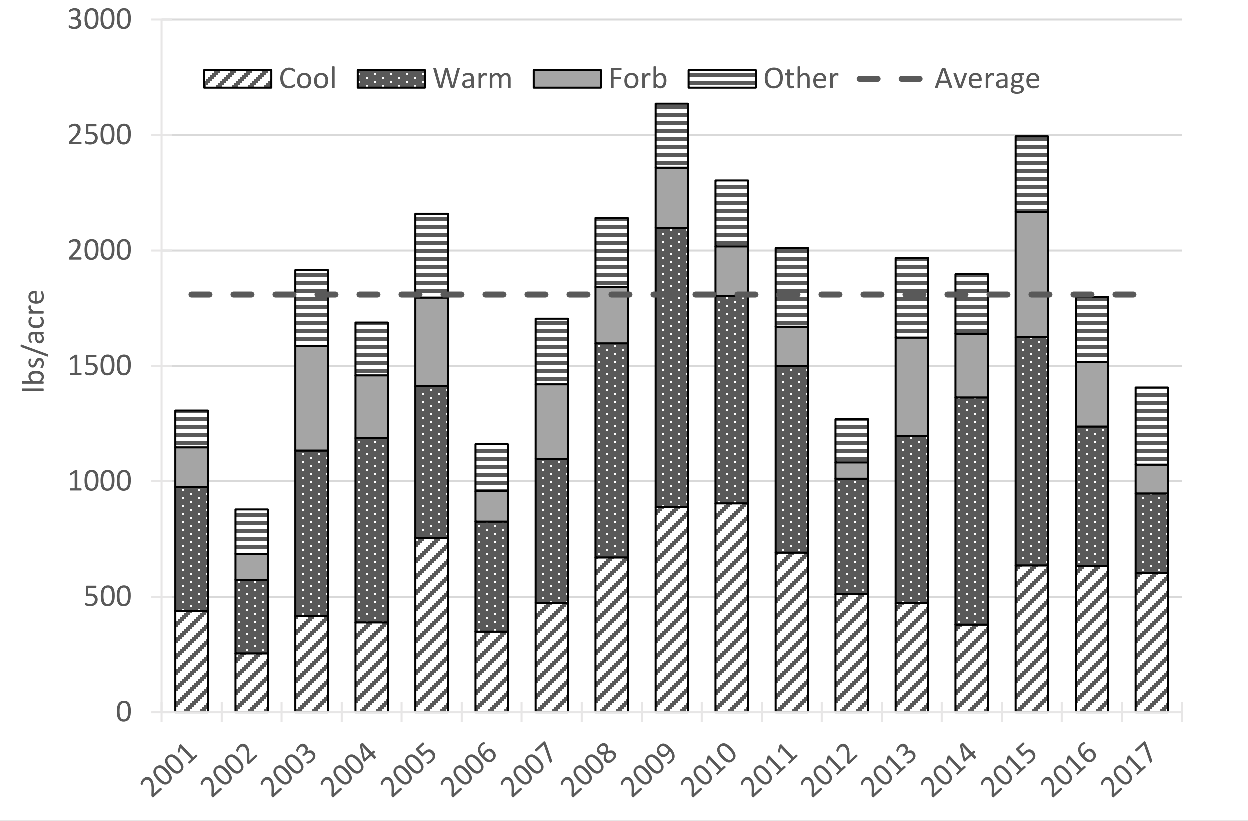
Walt Schacht

Subirrigated Meadow Characteristics

- Ground water at or near soil surface much of growing season – herbaceous plant roots within reach of groundwater
- Soil texture ranges from loamy sands to fine sandy loams
- Soil organic matter content of 1.7 to 3.0%
- Soil pH generally alkaline (>7.6)
- A limiting nutrient is P
- Usually ditched to provide a means of draining meadows of surface water and allowing for haying by late June to mid-July

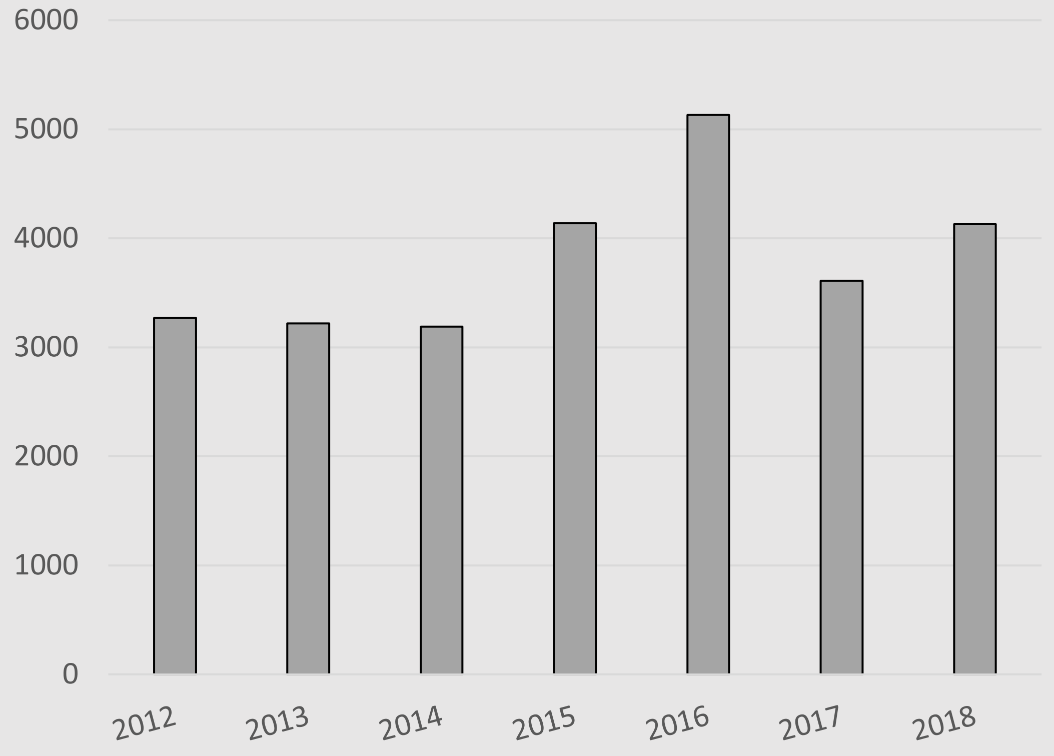
Aboveground Plant Production (BBR)

Upland Range



Stephenson et al. 2018

Subirrigated Meadow



Andrade et al. 2021

Species Composition

Cool-season grass meadow
(monocultures to diverse – 90+ species)

- Smooth and meadow bromegrasses
- Redtop bentgrass
- Timothy
- Slender wheatgrass
- Quackgrass
- Kentucky bluegrass
- Reed canarygrass
- Native sedges, rushes, and bulrushes
- Prairie cordgrass
- Legumes (mostly exotic) and other forbs

Native Warm-season grass meadow
(diverse)

- Big bluestem
- Indiangrass
- Switchgrass
- Prairie cordgrass
- Native sedges, rushes, and bulrushes
- Reedgrasses
- Wheatgrasses
- Native forbs
- Exotic cool-season grasses

Species Composition

Cool-season grass meadows

<30 inches to water table	>30 inches to water table
Sedges, rushes, and bulrushes	Redtop and bluegrass
Reed canarygrass	Slender wheatgrass and quackgrass
Prairie cordgrass	Timothy, bromegrasses, and legumes

As much at 80% of total biomass is exotic cool-grasses and native sedges and rushes

Ehlers et al. 1952
Mousel et al. 2007

Warm-season grass meadows

<30 inches to water table	>30 inches to water table
Prairie cordgrass and reedgrasses	Switchgrass
Sedges, rushes, and bulrushes	Big bluestem and little bluestem
Reed canarygrass and creeping foxtail	Indiangrass

As much as 85% of total biomass is native warm-season grasses

Root Mass of Cool-Season and Warm-Season Meadows

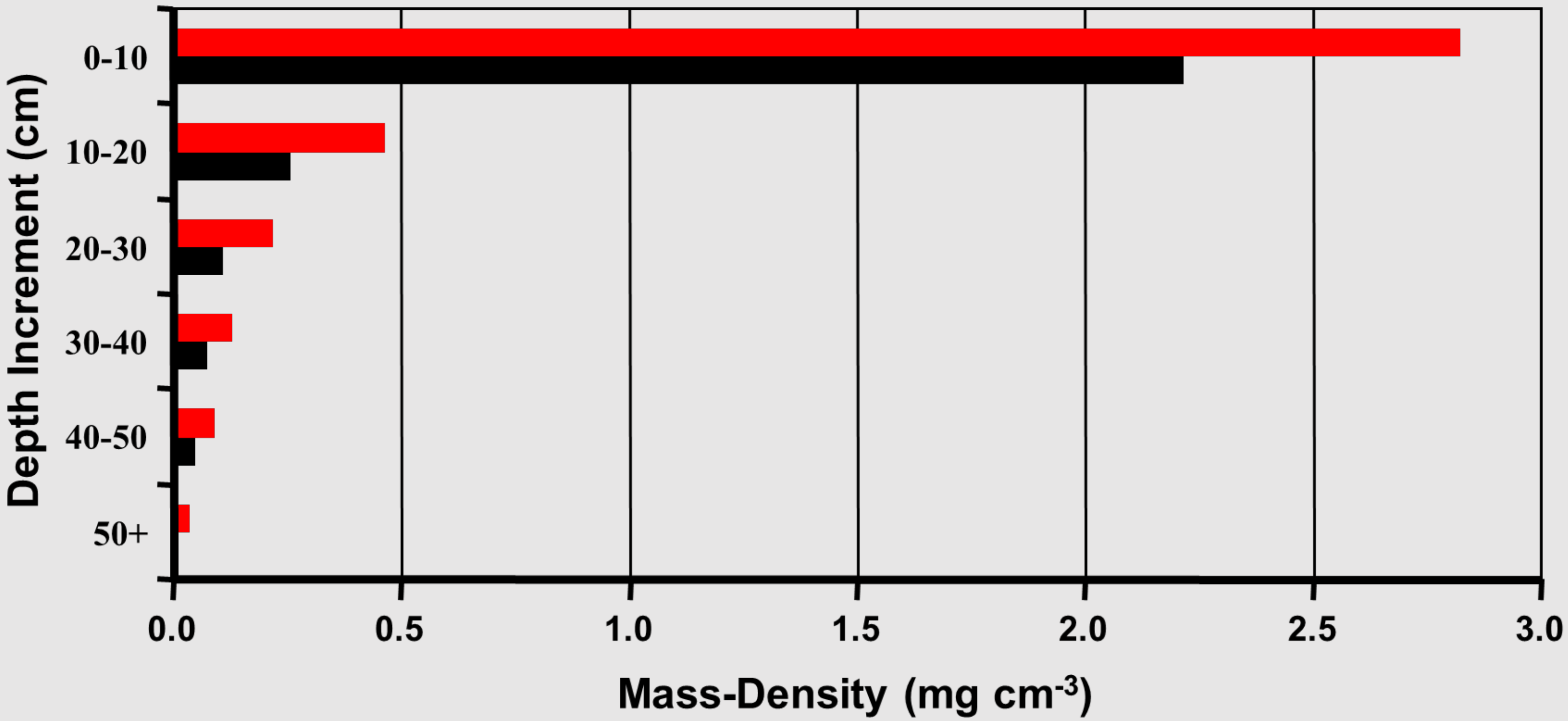
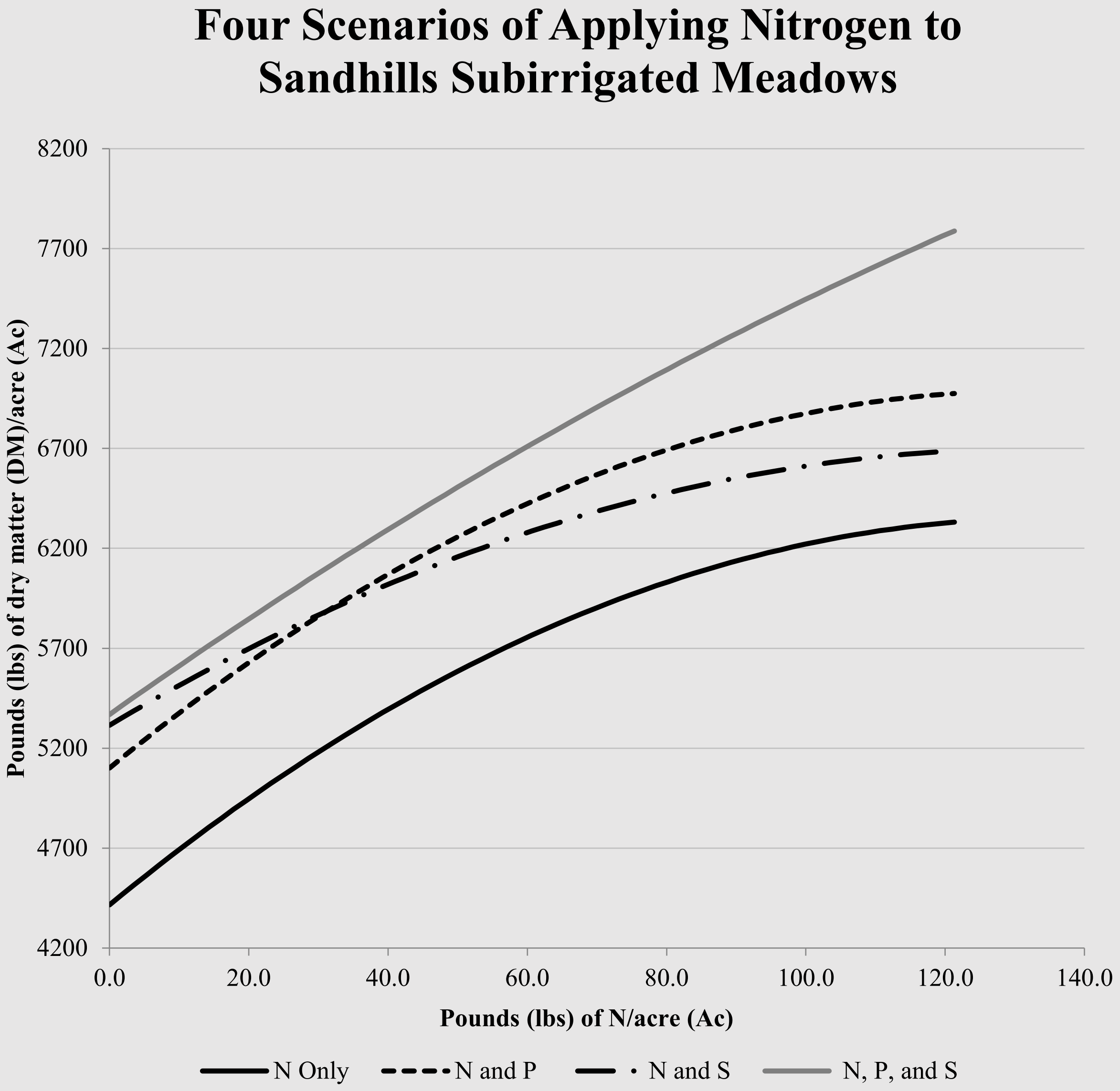


Fig. 7. Root biomass of cool-season and warm-season meadows in the Nebraska Sandhills, 2004.

Mousel et al. 2007

Fertilization

- Considerable research: Ehlers et al. 1952, Brouse and Burzlaff 1968, Nichols et al. 1990, Stockton and Wilson 2015
- Production potential is high because of shallow water table; limiting nutrients (P and N) can be effectively applied
- However, use of fertilizer dependent on hay value



Stockton and Wilson 2015

Forage Quality

- Variable – dependent on species composition
- Cool-season grass meadow ranges from **9% to 6.5% CP** and **62% to 55% TDN** in early to mid-July
- Mid-September aftermath can be **8% CP and 58% TDN** (Stott 2019)
- Fertilization results in increased yields but forage quality can be reduced by 1 percentage unit of CP (8.8 to 8.2%) and 3 percentage units of TDN (55 to 52%) (Nichols et al. 1990)
- General recommendation: optimize forage quality by early harvest, offset yield losses of early harvest by fertilization, and capture abundant quality, palatable late-season aftermath

Cool-Season vs Warm-Season Meadows

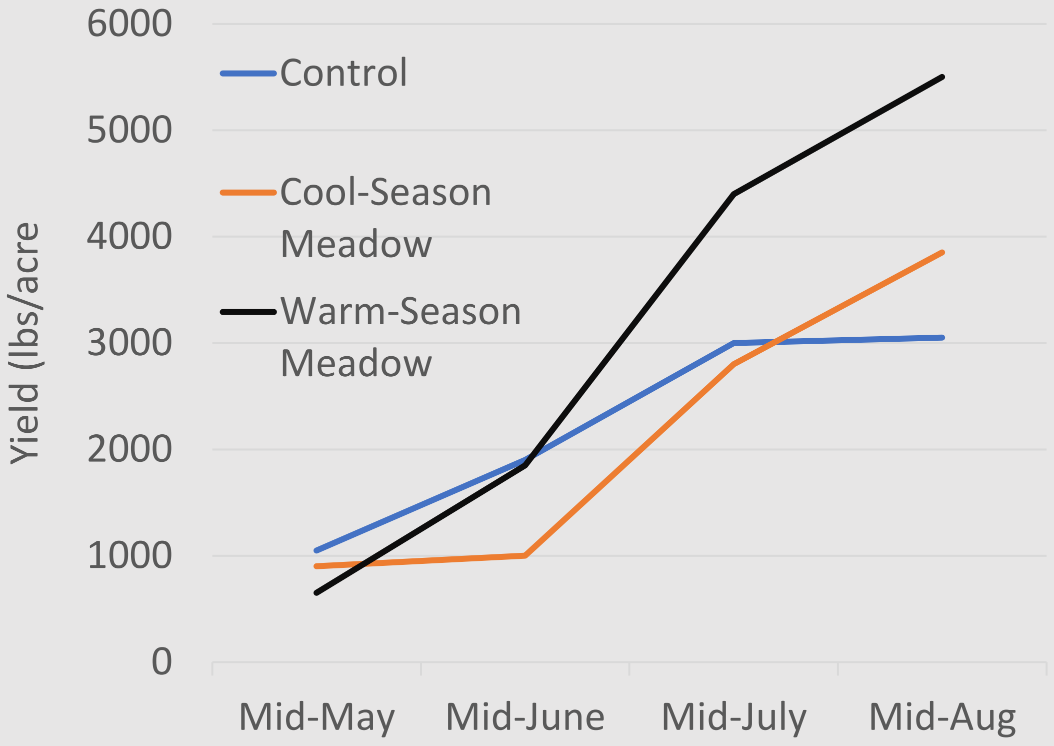
Fig. 1. Home Meadow at GSL

Fig. 2. Warm-season plot at North Meadow, BBR.

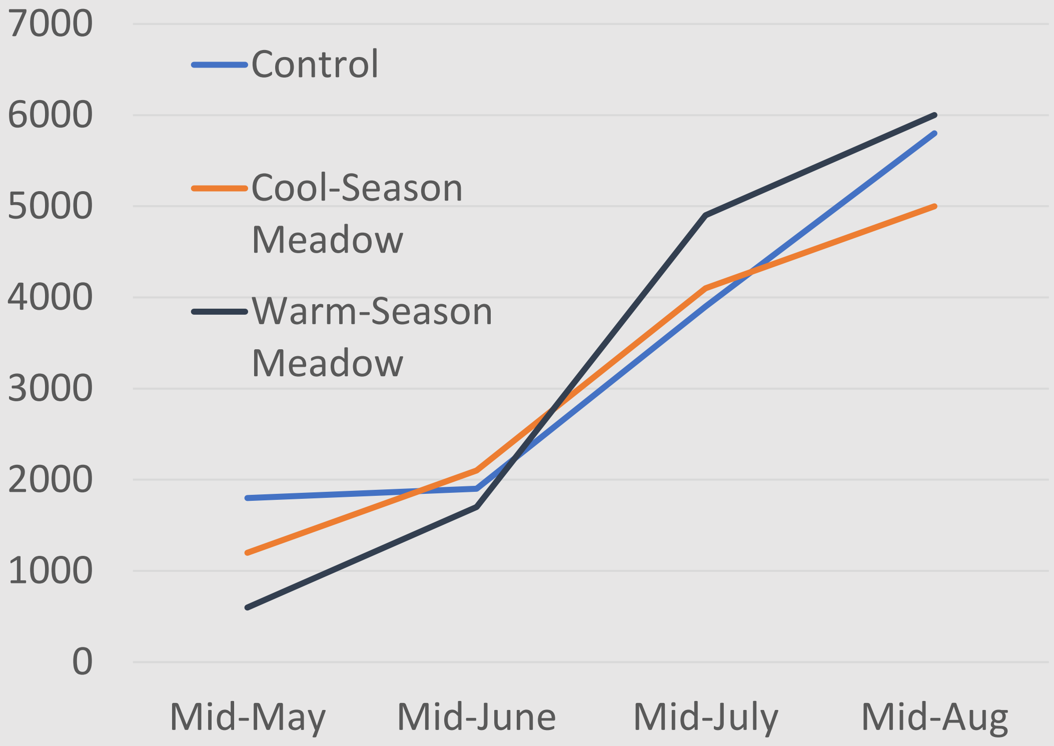
Bauer 2004

Aboveground Plant Production

Barta Brothers Ranch Meadow



Gudmundsen Sandhills Lab Meadow



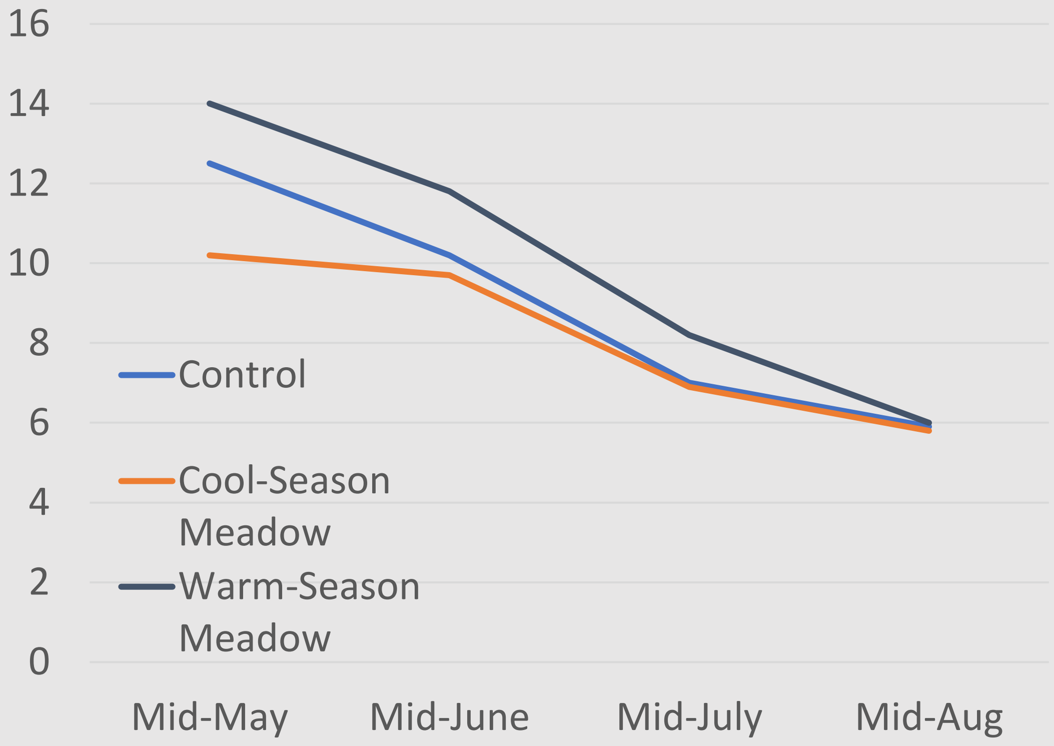
Bauer 2004; Brejda et al. 1989; McConnell and Waller 1984

Forage Quality

Crude Protein Content

- By mid-July, CP content of control and cool-season grass plots were similar
- CP content of cool-season grass plots were similar to reports for other cool-season grass meadows
- With the warm-season grasses, CP content was relatively high through mid-July

Crude Protein Content (%) of Meadows at BBR and GSL



Bauer 2004

Conversion to Warm-Season Grass Meadow

- Spring (May and June) grazing at high grazing pressure
- Late-May and June fertilization
- Application of herbicides (glyphosate) in spring or fall when warm-season grasses are dormant
- Renovation – reseeding or interseeding

Grazing Meadows

- Increased aboveground plant production
  Andrade et al. 2021
- Decreased belowground plant production
  Beckman 2014
- Shift in species composition
  Andrade et al. 2021
- Increased structural heterogeneity
- Increased carrying capacity/stocking rate

Aboveground Plant Production

- There was a treatment x year interaction for aboveground plant production (p = 0.05).

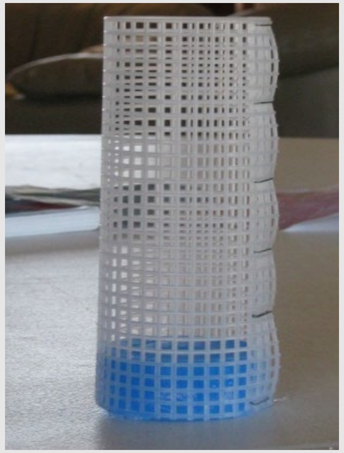
- In 2013-2015 and in 2018 grazed treatments had greater aboveground production than the control.

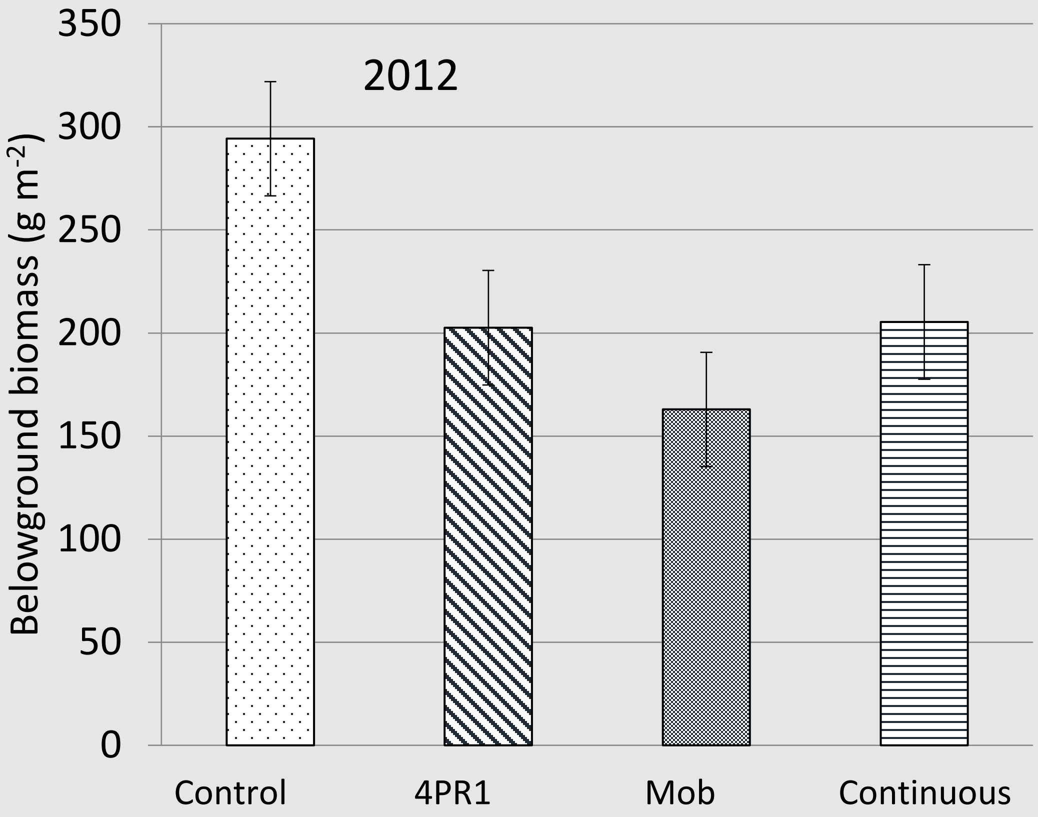
  Andrade et al. 2021; Richardson 2002

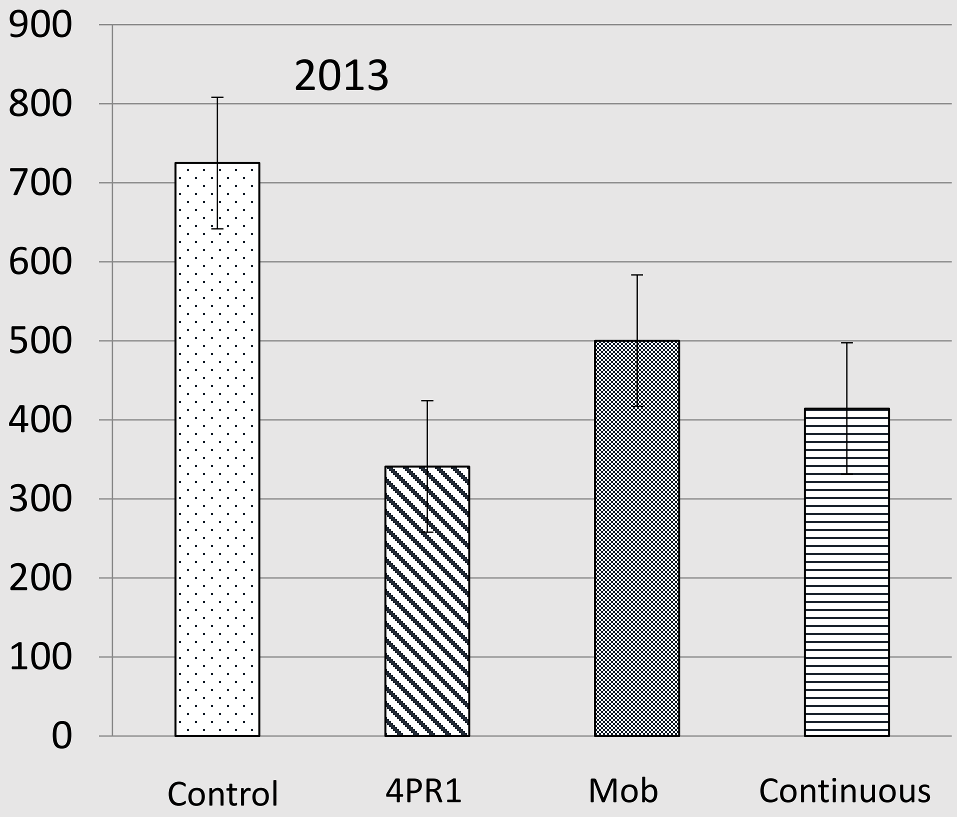
	Year (lbs/acre)						
Treatment	2012	2013	2014	2015	2016	2017	2018
4PR1	4000^{Aac}	3950^{ABac}	4050^{Aac}	3980^{Ac}	4810^{Aac}	4050^{Aac}	5830^{Ab}
4PR2	3890^{Aa}	3710^{ABba}	4330^{Aac}	5180^{BCd}	4930^{Abc}	3750^{Aa}	5800^{Ae}
Mob	3520^{Aa}	4220^{Aabcd}	4680^{Abcd}	4910^{CDc}	4710^{Acd}	4000^{Aad}	5960^{Ae}
Control	3270^{Aa}	3220^{Ba}	3190^{Ba}	4140^{ADbd}	5130^{Ac}	3610^{Aab}	4130^{Bd}

[1] Means with different uppercase letters within columns differ ($P < 0.10$).
[2] Means with different lowercase letters within rows differ ($P < 0.10$).

Belowground Annual Production at BBR







Beckman 20014

Species Composition at BBR

- The warm-season grasses, big bluestem and prairie cordgrass, remained relatively constant in the grazed treatments and prairie cordgrass increased in the control and hay treatment.
- Change in composition of each of the cool-season graminoids did not differ among the treatments.
- White clover composition (%) increased over time for the grazed and hay treatments while it declined on the control.

Species	4PR1 % Change	4PR2 % Change	Mob % Change
Warm-season grass			
Big bluestem	-0.25	0.3	0.7
Prairie cordgrass	-1.1	-1.2	-1.3
Cool-season graminoid			
Quackgrass	28.3	19.2	21
Timothy	-8.5	-11.4	-8.3
Kentucky bluegrass	8.9	7.7	3.2
Sedge	-21.3	-17	-15.8
Forb			
Red clover	-0.4	-1.1	-2.5
White clover	4.2	6.3	3.4

Andrade et al. 2021

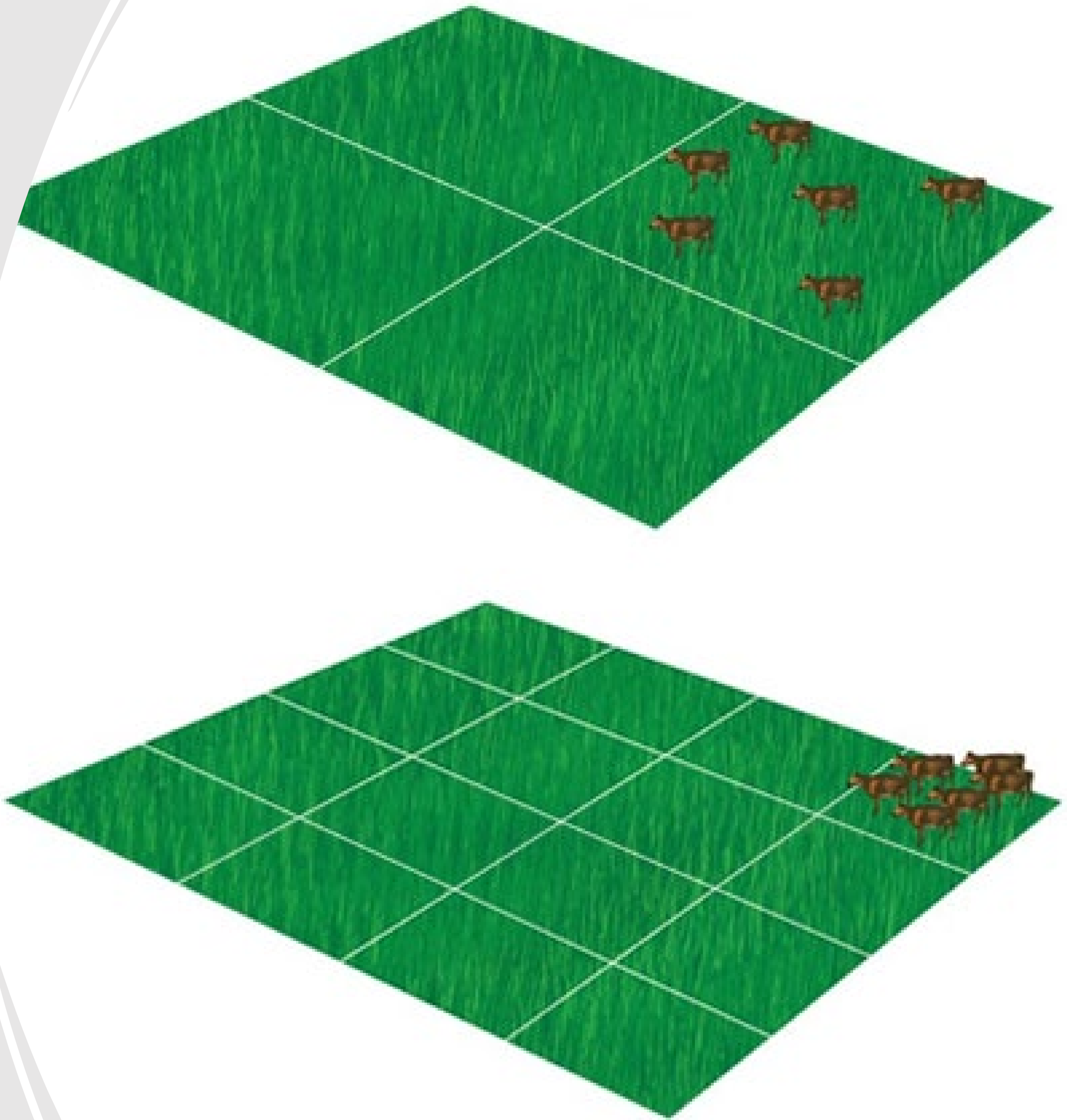
Structural Heterogeneity

Patchy (low stocking density)

Uniform (high stocking density)

High Carrying Capacity/Stocking Rate

- Carrying capacity is relatively high (3.0 AUM/acre or greater)
  - High aboveground plant production
  - Plant growth potential following grazing is high
  - Grazing strategies can be used to achieve high harvest efficiency

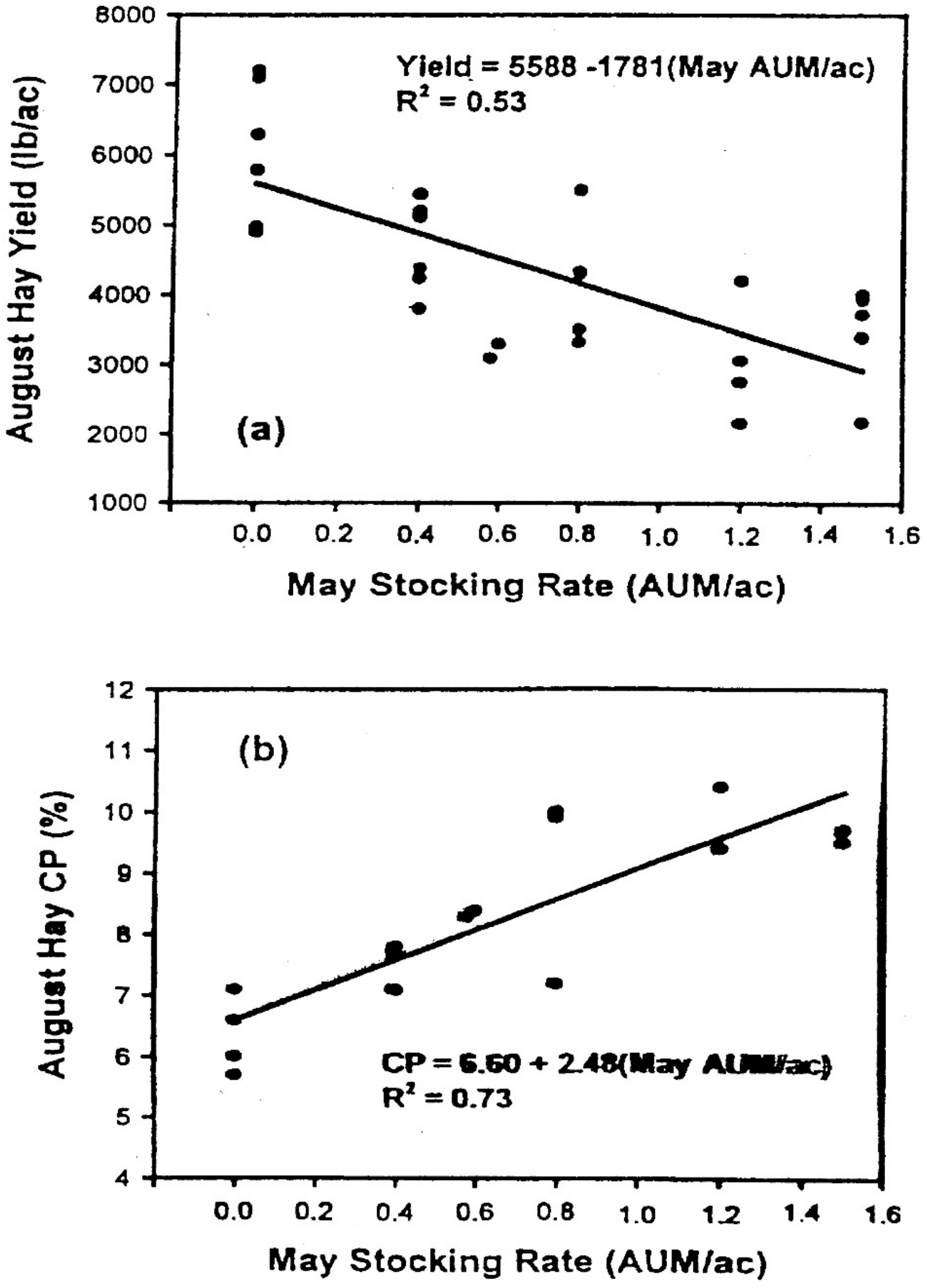


Grazing Strategies on Meadows

- An early reference to grazing meadows was by Clanton and Burzlaff in 1964
- May/June grazing followed by haying in August
- Grazing during growing season (May-August)
- Fall grazing (aftermath grazing)
- Windrow grazing

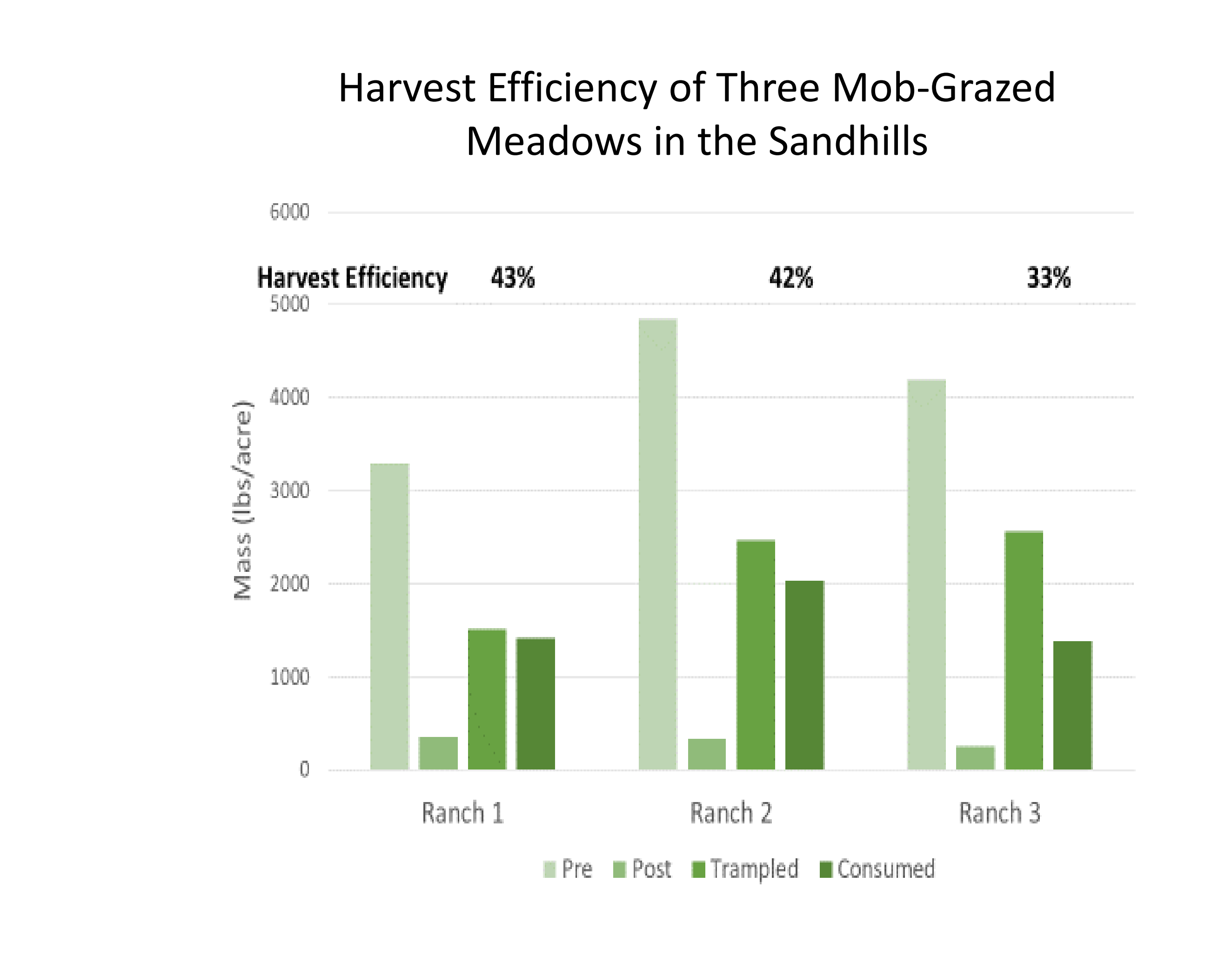
Early-Season Grazing

- Grazing mid-May to early June
- High forage quality and matches high nutrient requirements of early lactating cows
- Profitability increases because less hay is fed during winter/spring period
- Higher forage quality of hay harvested later in the growing season
- Increases flexibility in timing of follow-up hay harvest – yield, forage quality, and wildlife habitat
- Horney 1999



Season-Long Grazing

- High carrying capacity because of high production and forage quality and potential for harvest efficiency
- Simple rotation systems (4 or 5 pastures with 1 grazing cycle)
- Management intensive grazing strategies can be used to increase harvest efficiency



Wingeyer et al. 2014

Season-Long Grazing – Barta Brothers Ranch

- Simple rotational grazing system: (4 pasture rotation with 1 or 2 grazing cycles)
- Management intensive grazing: mob grazing (ultrahigh stocking density) with 1 cycle
- 60 to 80 day grazing season with 0.5 to 15-day grazing periods
- 3 AUM/acre stocking rate

Grazing System	Plant Production	Forage Quality	Harvest Efficiency	ADG
4PR1	=	-	-	-
4PR2	=	+	-	+
Mob	=	-	+	-

Andrade et al. 2021

GSL Grazing Study (Volesky et al. 2002):

- 4 AUM/acre optimum stocking rate
- No benefit to more than 3 grazing cycles

Windrow Grazing

to increase harvest efficiency and reduce harvest/feeding costs

Volesky et al. 2002

- Graze in May at 1.3 AUM/acre
- Fertilize with N, P, and S in early June
- Windrow in early to mid-September
- Bale alternate windrows
- Graze remaining windrows November-January

Windrow Grazing

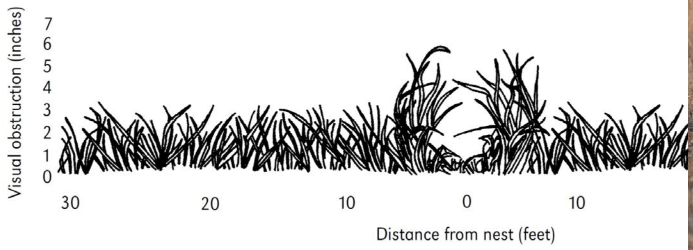
- Similar calf gains
- Windrowed and baled hay maintained similar forage quality over time
- Little to no effect of grazing windrows on subsequent herbage yield
- Feeding costs were $0.16/hd/day under windrow grazing compared to $0.34/hd/day for bale feeding
- Net gain per head averaged $19.87 higher for windrow grazing than for bale feeding

Year		Windrow Grazing	Bale Fed
1997/98	Total Gain	81 lbs	60 lbs
	Daily Gain	1.17 lbs	0.86 lbs
1998/99	Total Gain	42 lbs	37 lbs
	Daily Gain	0.57 lbs	0.51 lbs

Wildlife Habitat Greater Prairie-Chicken

Powell et al. 2020
Hiller et al. 2019
Olney Harrison et al. 2017

- Leks – closely cropped areas because of haying or intensive grazing
- Nesting – patchy structure especially in dry years when upland sites don't provide adequate nesting habitat
- Fledglings - meadow vegetation generally too dense for fledglings



Wildlife Habitat Meadowlarks

Giovanni 2009
Giovanni et al. 2015

- Haying date of mid-July has little effect on nest and fledgling survival
- Plant structure important – woody plants and tall herbaceous plants important for adults and fledglings to get away from predators and inundation
- Fledglings selected sites with shallow litter and taller standing vegetation

Managing Wet Meadows

- Prescribed Burning
- Reseeding/Interseeding
- Manipulating Drainage
- Recreation/Aesthetics
- Other