Low Cost Feeding and Management Practices for Grazing Cow-Calf Operations Under Seasonal Supplementation

季节性补饲条件下育犊母牛放牧低成本饲养和管理措施

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Low Cost Strategies 低成本策略

- Match cow to environment 母牛与环境相匹配
  - Cow mature size 成年母牛体型
  - Level of milk 产奶水平
  - Calving season 产犊季
- Utilize grazed forages to greatest extent possible
  尽可能使用放牧饲养
- Match hay quality to cow needs
  干草质量满足母牛的需求
- Provide suitable supplement
  提供适当的补充料

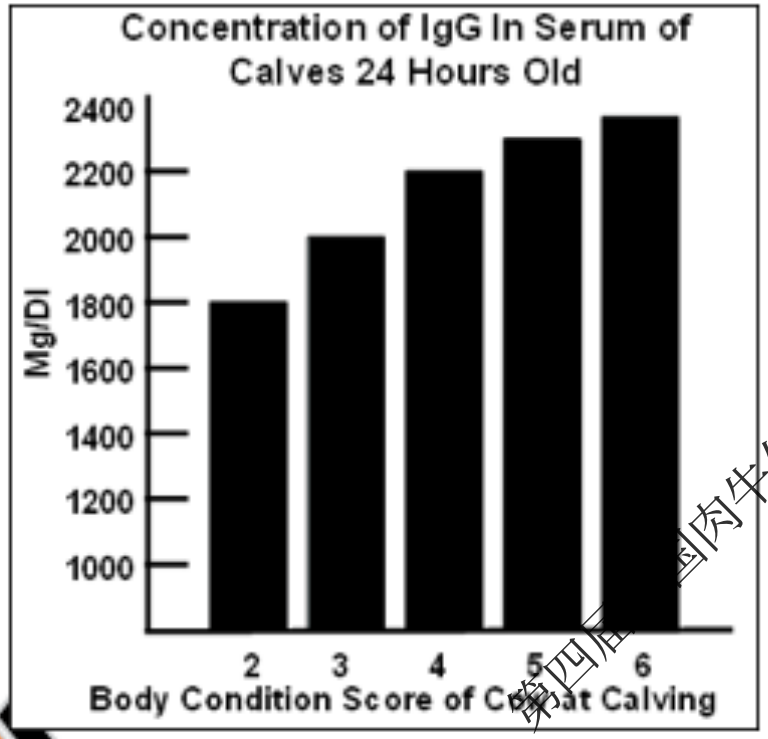
Key to Cow-Calf Profitability 育犊母牛盈利的关键

- Wean a live calf every 365 days 365天生产一只健康断奶犊牛
- Keep body condition on cows 保证母牛的体况评分
  - Have longer post partum interval and lower conception rates
    延长产后发情间隔，降低受孕率

Body Condition Score at Calving 产犊时体况评分	Post Partum Interval 产后发情间隔
3	89
4	70
5	59
6	52
7	31

Body Condition Scores 体况评分

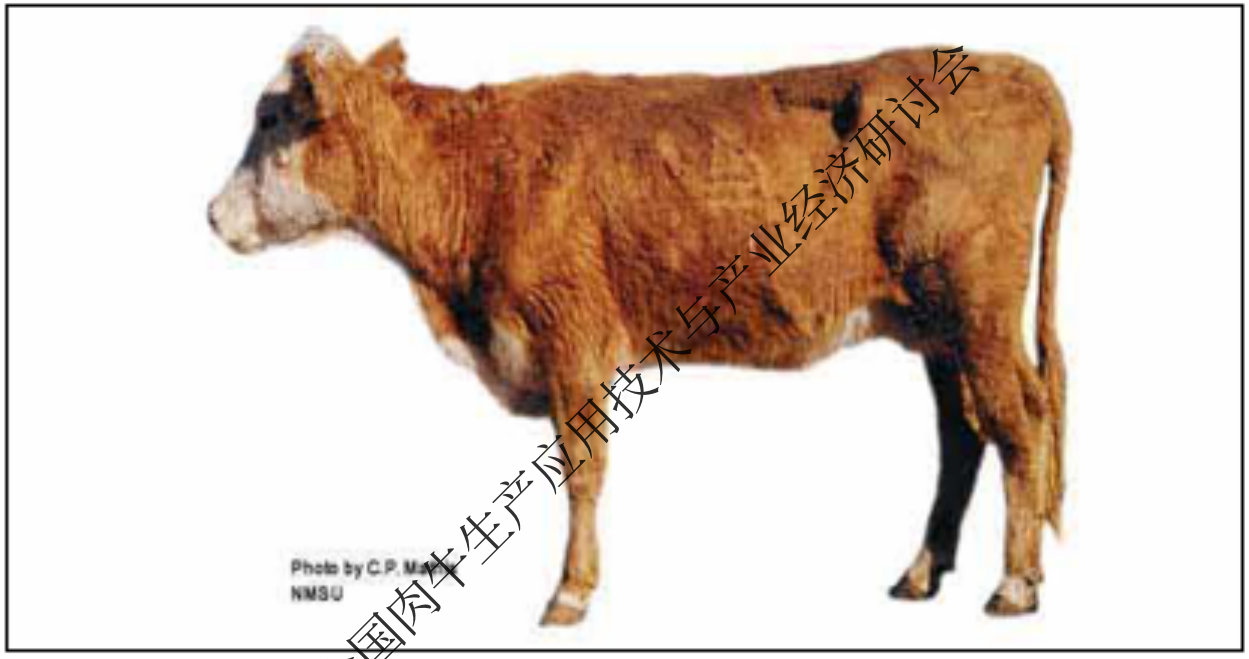
犊牛出生24h后血清中IgG浓度



母牛产犊时的体况评分

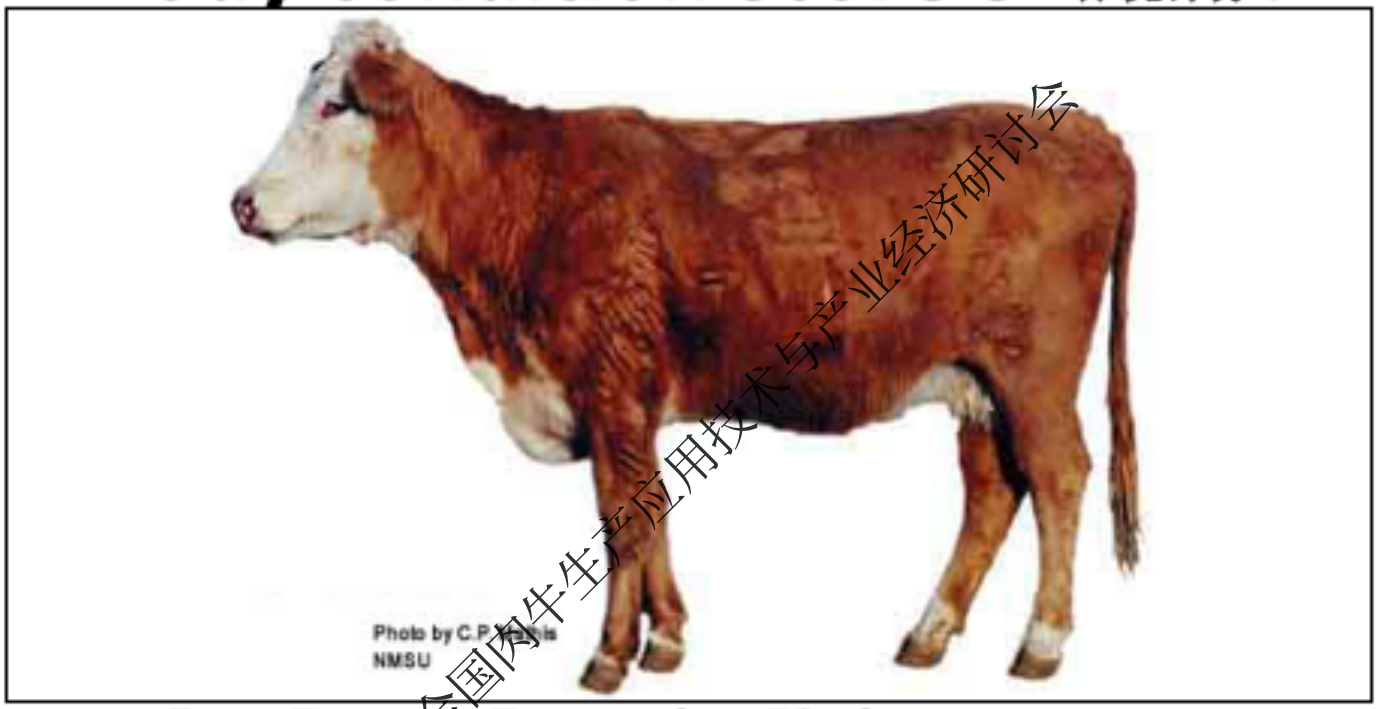
- Thin cows have less colostrum.
  体型偏瘦的母牛初乳量较少
- Less immune cells
  免疫细胞少
- Failure of immune transfer to offspring
  犊牛无法获得被动免疫
  - Increase incidence of scours 增加腹泻发病
  - BRD 呼吸道疾病发病率高
  - Lower weaning weights
    断奶体重较低

Body condition score 3 体况评分 3



- Post Partum Interval = 90-days 产后发情间隔 = 90天
- 30% pregnant in 60-day breeding season
  60天配种季的怀孕率为30%

Body condition score 5 体况评分 5



- Post Partum Interval = 59-days 产后发情间隔 = 59天
- 89% pregnant in 60-day breeding season
  60天配种季的怀孕率为89%

1-point increment = ~80 lbs

体况评分每增加1分=约36.29公斤

Body condition score 6 体况评分 6

- Post Partum Interval = 52-days产后发情间隔 = 52天
- 95% pregnant in 60-day breeding season
  60天配种季的怀孕率为95%

Matching the Cow to the Environment

母牛与环境相匹配

Energy Requirements 能量需求

- Key requirement factors 能量需求的关键点
  - Weight 体重
  - Rate of gain 增重率
  - Body Condition 体况评分
    - Thin cows require additional energy to restore body condition
    瘦牛需要补充额外的能量来恢复体况
  - Lactation/fetal development 泌乳/胎儿发育

Compared to dry stage, lactating cows require 130 to 170% (30 to 70% INCREASE) dry matter, energy and protein requirements compared to cows in dry stage
哺乳期母牛饲料中的干物质，能量和蛋白需求要多是干奶期的1.3-1.7倍

Increasing Cow Size 母牛体型的增长

- McMurry, 2008 Feedstuffs Article
  McMurry在2008《饲料》的一篇文章指出
  - Based on cow slaughter data
    母牛屠宰数据表明
  - Estimated cow BW has increased 30% from 1975 to 2005
    自1975至2005期间，母牛体重已经预计增长了30%
    - From 476 kg to 622 kg 从476公斤至622公斤
  - 30% larger cow requires…
    体重增加了30%的母牛需要…
    - 22% more maintenance energy 额外22%的维持能量
    - 22 to 28% more forage 额外22%-28%的牧草

McMurry, M. 2008. Just how big are our beef cows these days? Feedstuffs. Vol. 80 no. 51 pp. 16-17.

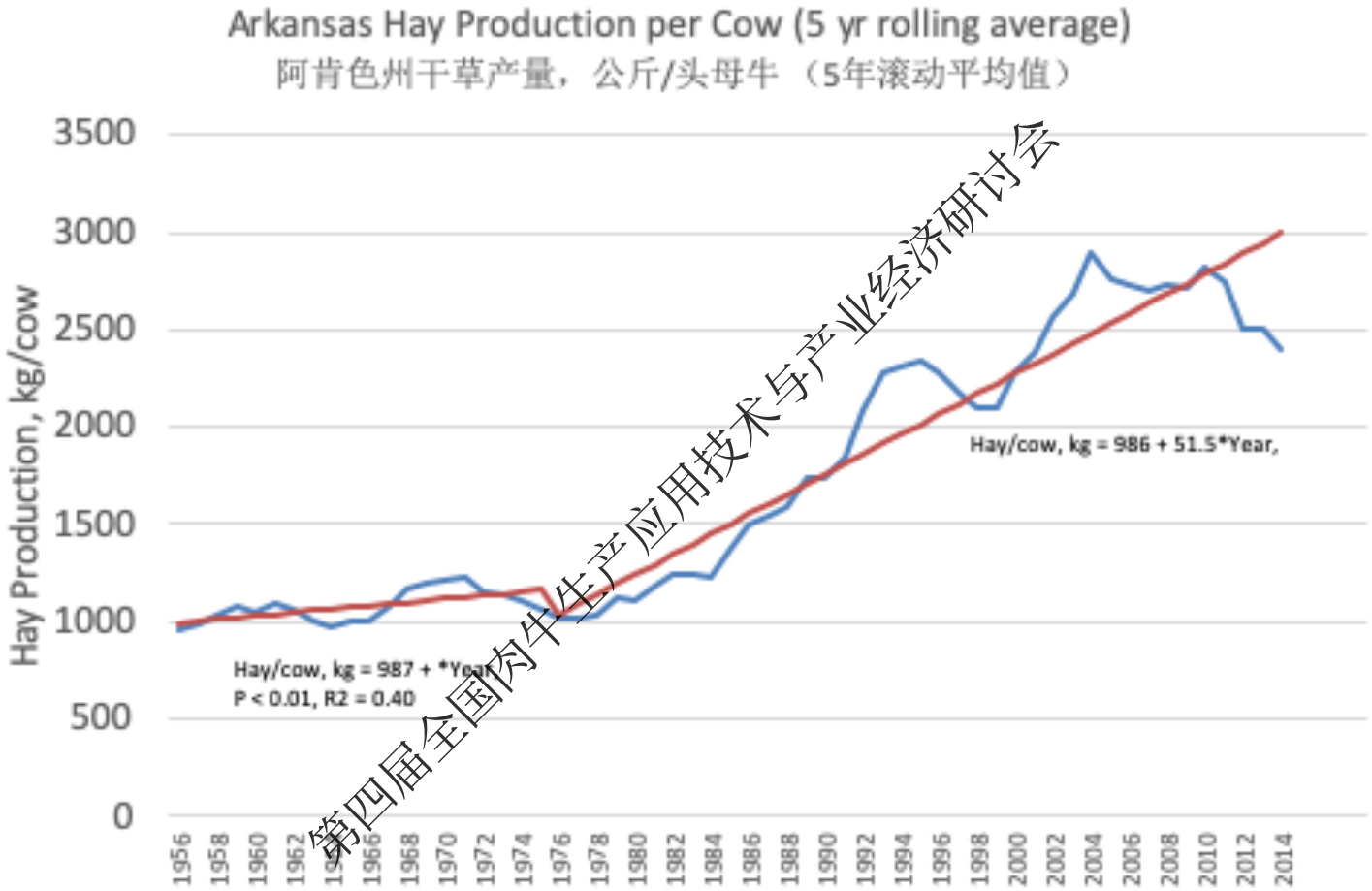
Interest in 'Intensification' of Cow Production

致力于母牛“集约化”的生产方式

- Increases in intensification… 集约化生产方式的增加…
  - Increased hay feeding since mid-1970's 自1970年代中期以来，干草饲喂量一直增加
    - Gary Vermeer – 605 round baler 1973

      Gary Vermeer在1973年建造了型号605的圆捆裹包机
      - And we haven't looked back since!

        从那以后我们就没有停止过前进的脚步！



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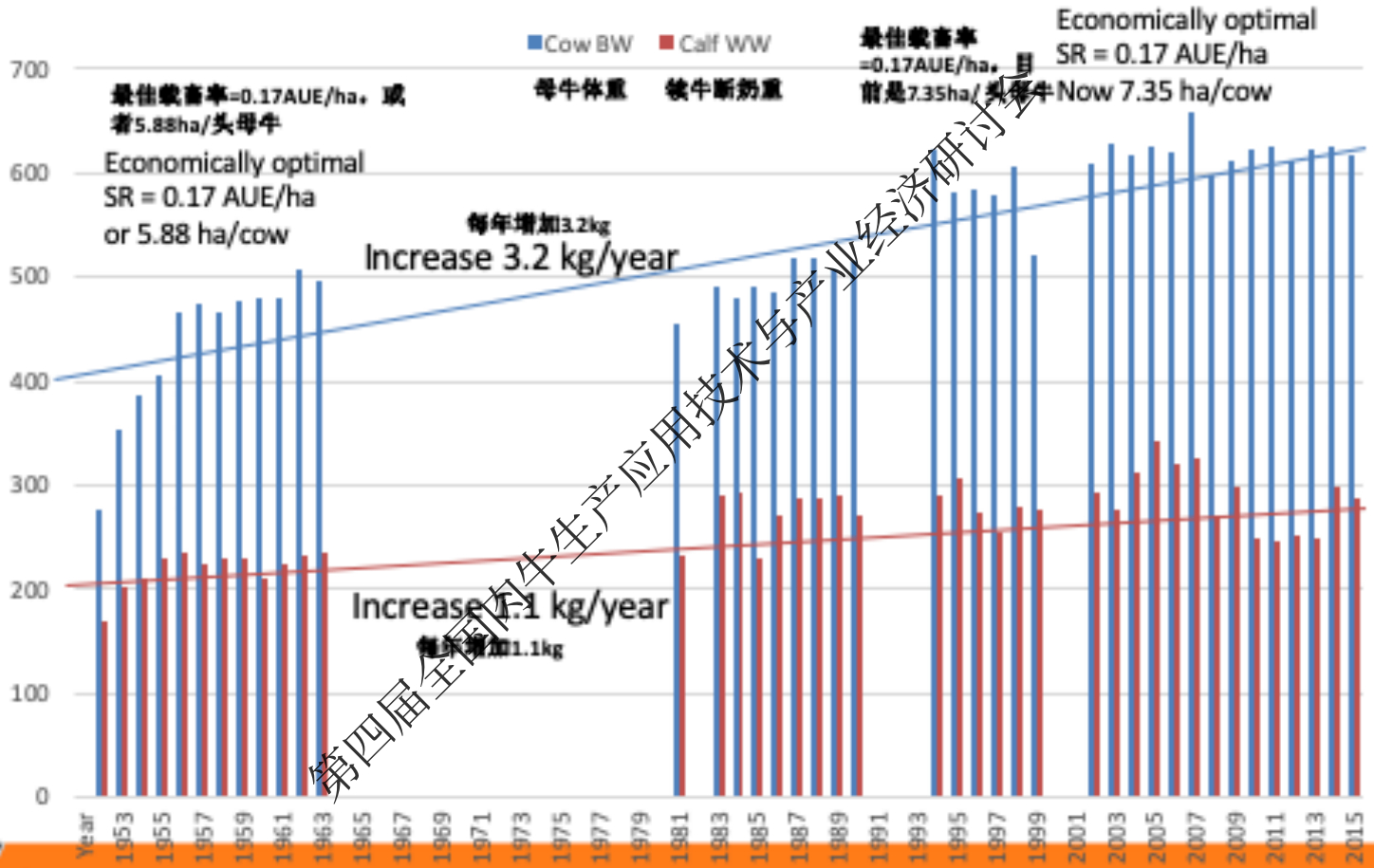
  - Increasing cow size lead to increased stocking rates.

    母牛体型的增长致使土地载畜率的增加
    - 476 kg cow = 1.0 AUE 476kg母牛=1.0 动物单位当量
    - 622 kg cow = 1.3 AUE 622kg母牛=1.3 动物单位当量

Larger Cows in NW OK 西北部俄克拉荷马州母牛数据



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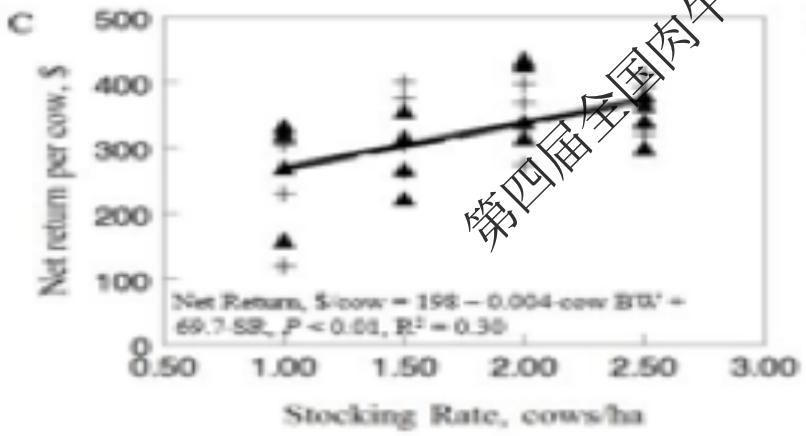
Larger Cows in SW Arkansas西南部阿肯色州母牛数据

- As Cow mature BW increased from 378 to 736 kg
  如果成年母牛体重从378kg增至736kg
  - calf WW increased by 19 kg for each 100 kg increase cow BW
    母牛体重每增加100kg，其犊牛断奶体重增加19kg
  - Weaning efficiency decreased (kg calf WW/kg cow BW) 6.7 kg/100 kg cow BW
    断奶效率下降（每kg母牛得到的断奶犊牛重量）6.7kg/100kg母牛体重
  - Did not affect kg hay fed, hay feeding days, or cost of winter feeding
    对干草饲喂量，干草饲喂天数或冬季饲喂成本无任何影响
- As SR increased from 1 to 2.5 cows/ha
  如果当土地载畜率每公顷1头母牛增加至2.5头
  - Calf WW & weaning efficiency was not affected
    犊牛断奶体重及断奶效率并未受影响
  - Hay feeding increased, but so did kg calf weaned per ha
    干草饲喂量增加，同时每公顷断奶犊牛体重也增加



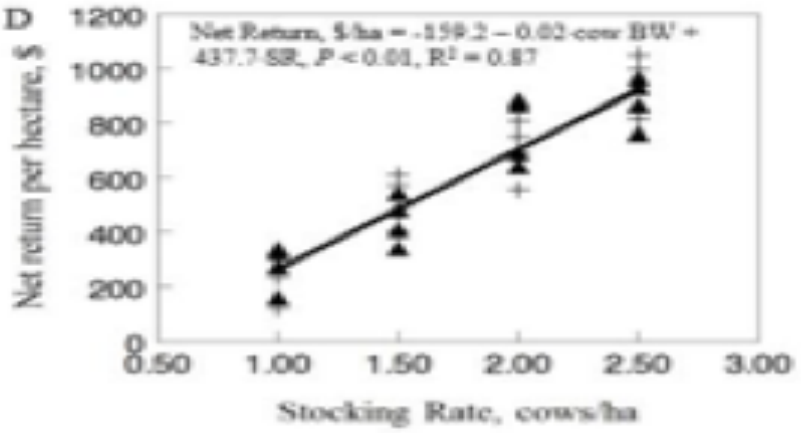
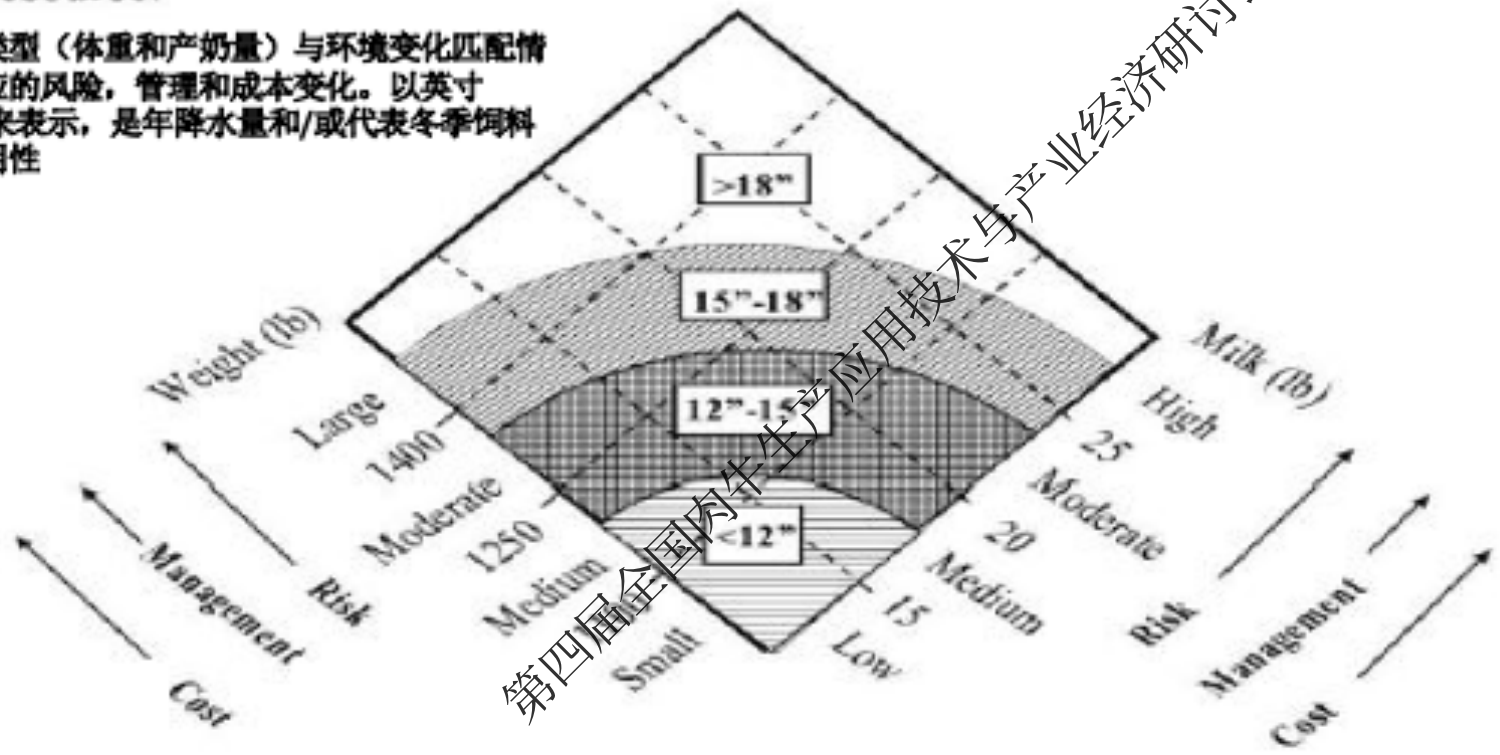


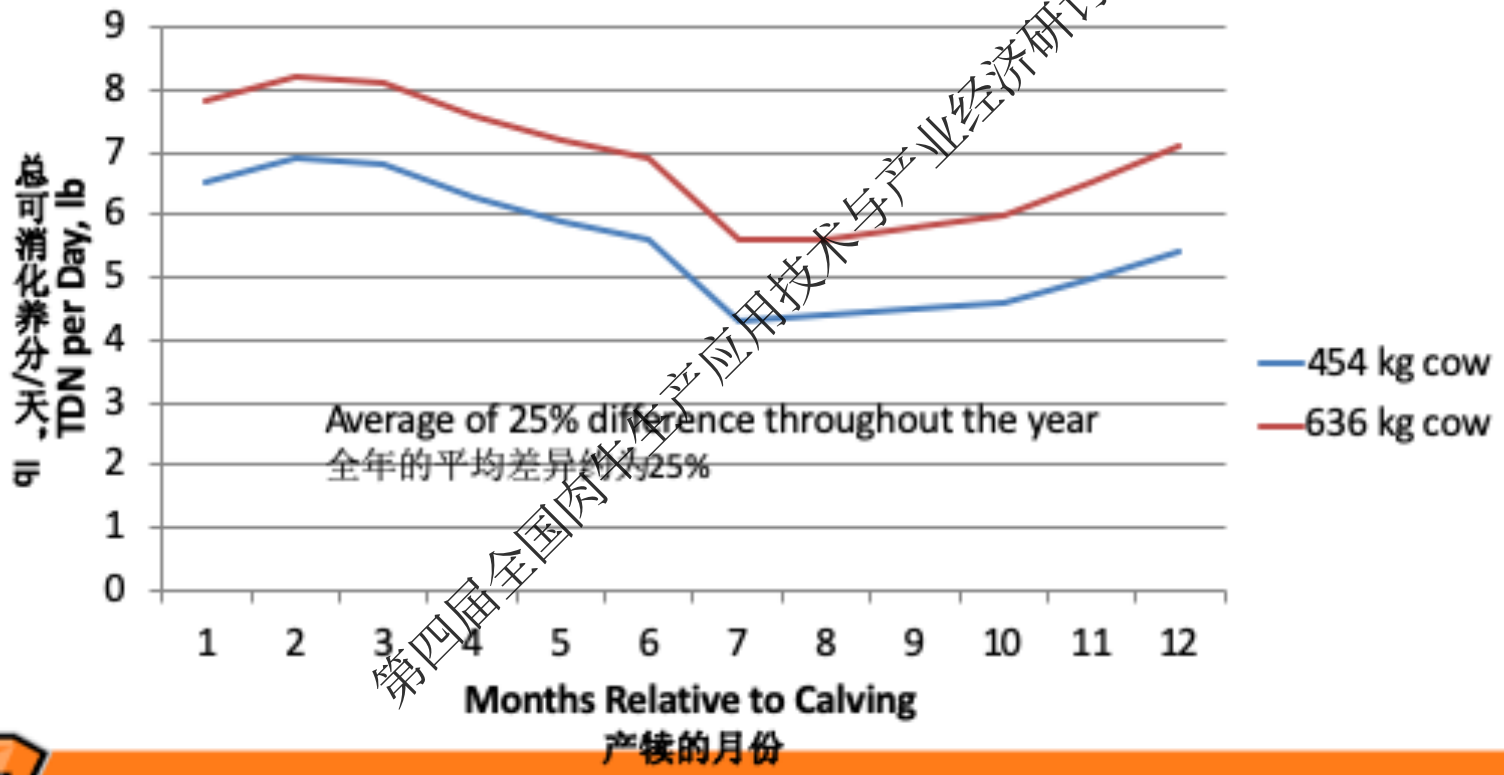
Figure 1. Matching cow biological type (weight and milk) to range environment, with associated risk, management, and cost. Ranges in inches (12"-15") are annual precipitation and/or represent availability of winter feed resource.

母牛的生物类型（体重和产奶量）与环境变化匹配情况，以及相应的风险，管理和成本变化。以英寸（12"-15"）来表示，是年降水量和/或代表冬季饲料资源的可利用性



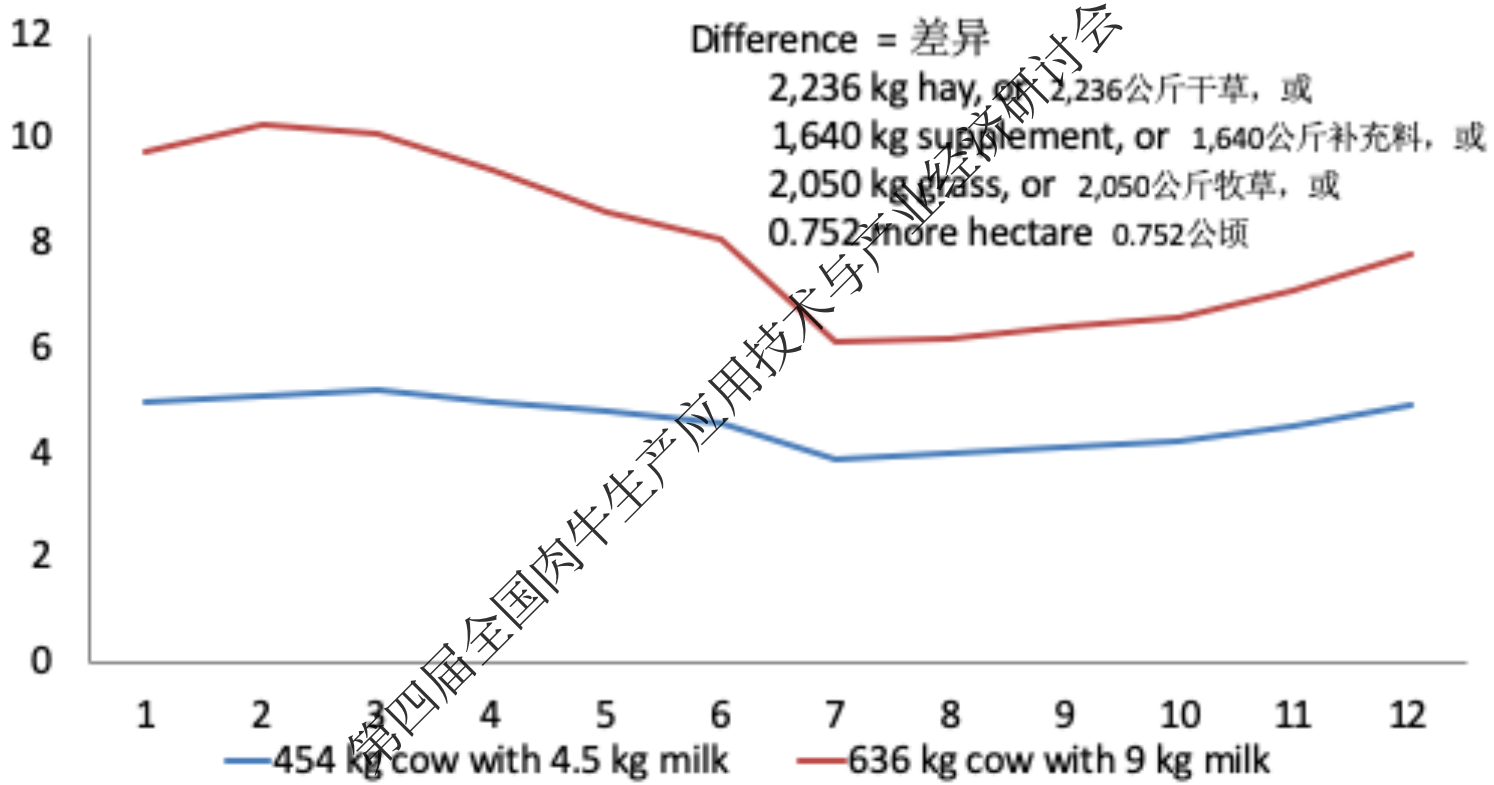
Mature size VS Energy Requirements

成年体型与能量需求的对比



Mature size and Milk VS Energy Requirements

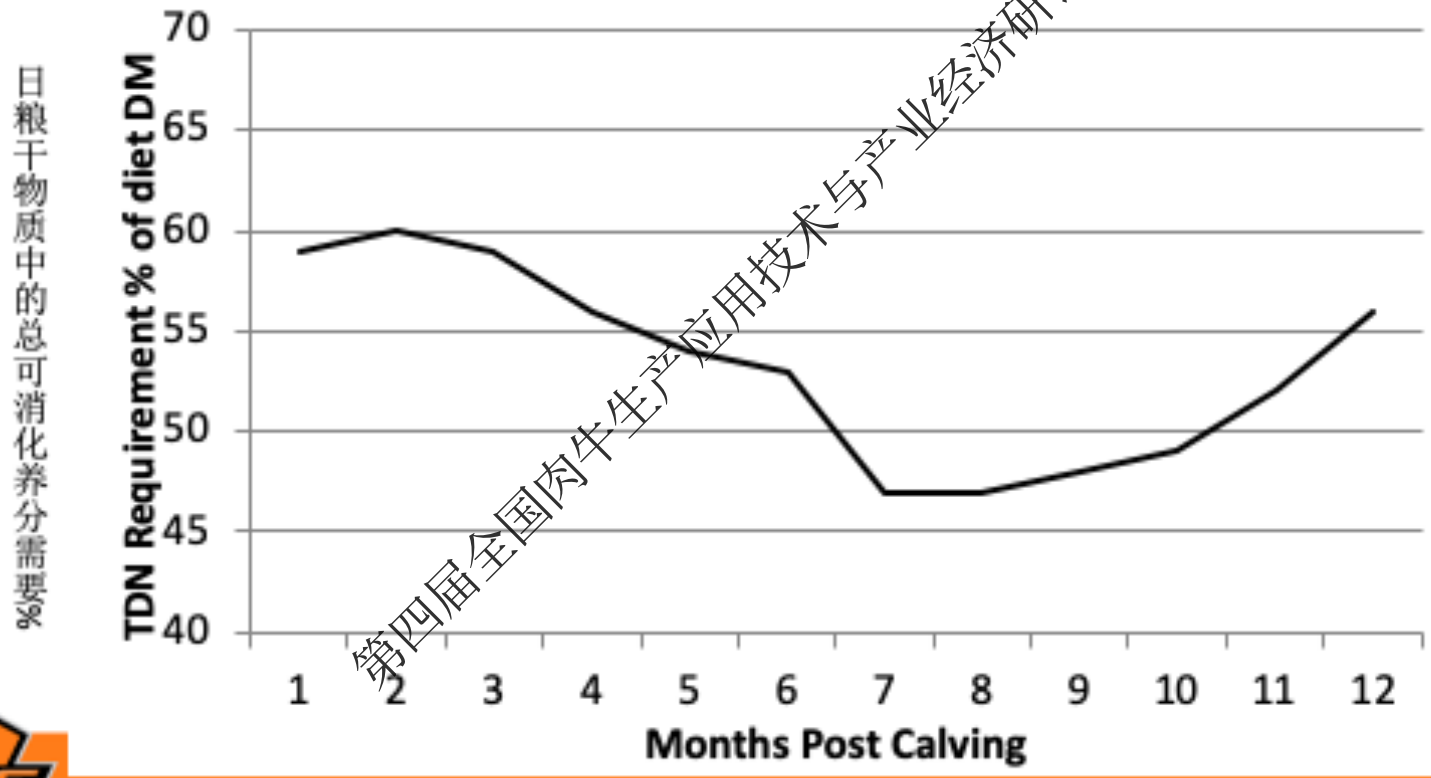
成年体型和产奶量与能量需求的对比



1,000 / 10 = cow wt / peak milk yield 母牛体重/产奶高峰值

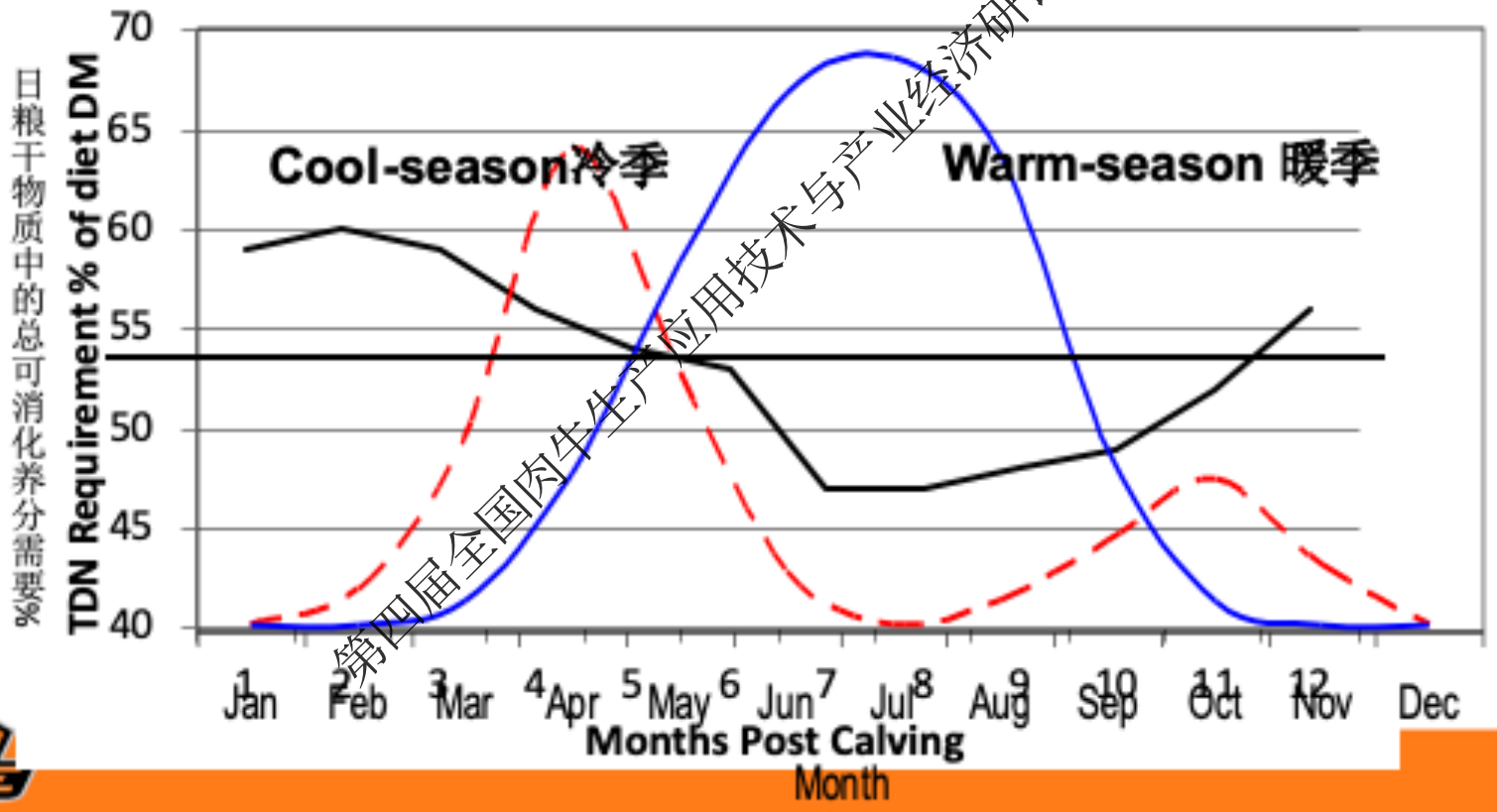
Annual Cow Nutrient Requirements

全年母牛营养的需求



Annual Cow Nutrient Requirements

全年母牛营养的需求



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Summary and Recommendations

总结和建议

- Cows with lower nutritional requirements consume less forage and have lower nutrient requirements

  对营养需求较低的母牛牧草采食量也较低，对营养的需求也较低

- Match calving season with the best forage production potential

  将产犊季与牧草最佳生长潜力相结合

  - Decrease stored feed requirements

    减少饲草料储存需求

  - Decrease hay nutritional quality

    可适当使用低品质干草

  - Decrease supplementation

    减少补充料的投入

Forage Management Strategies

牧草管理措施

- Improved grazing management 提升放牧管理
- Targeted fertilization 目标施肥
- Stockpiling 牧草储备
- Complementary forages 互补牧草
- Integration of multiple management strategies
  整合多种牧草管理措施

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Improved Grazing Management

提升放牧管理

- Rotational grazing often results in decreased animal performance

  轮牧通常会导致动物生产性能的下降

  - Stocker 架子牛
    - Gillen et al., 1992 – Rotationally grazed steers gained 17% less than continuous grazing

      与持续放牧相比，采取轮牧方式放牧的阉牛在增重方面要少17%
  - Cow Calf 育犊母牛
    - Wyatt et al. 2013 – Rotational Grazing @ 2 cow/ha SR decreased WW by 22 kg and pregnancy rate by 14%.

      每公顷2头母牛的载畜率，在轮牧情况下，会导致犊牛断奶体重下降22公斤，母牛怀孕率下降14%
    - Beck et al. 2016 – Rotational Grazing @ 1.25 cow/ha SR decreased WW by 10 kg 贝克等人，

      每公顷1.25头母牛的载畜率，在轮牧情况下，会导致犊牛断奶体重下降10公斤

Improved Grazing Management

提升放牧管理

- Rotational grazing often results in decreased animal performance轮牧通常会导致动物生产性能下降
- Harvest efficiency increases
  牧草收割效率提升
- Persistence of “Ice Cream” plants improves
  “Ice Cream”植株的持久生长得到提升
- Additional management can be applied 额外管理措施
  - Stockpiling, complementary forages, clovers
    储备，互补牧草，三叶草

Limit-Grazing Cool Season Annuals

一年生冷季牧草限牧饲喂

- Cows grazing stockpiled bermudagrass respond to supplementation (Wheeler et al., 2002 & Johnson et al., 2002)
  母牛采食储存的百慕大草后对补充料的反应
- Gunter et al. (2002) reported that compared with cows fed supplements, cows limit grazing cool-season annuals 2- to 3-d/wk,
  与母牛饲喂补充料相比，母牛每周限牧一年生冷季牧草2-3天，则
  - Increased BCS 体况评分增加
  - No affect on BW, WW, or conception 对初生和断奶体重及怀孕无影响
  - Decreased hay 干草投放量减少

Limit-Grazing Overseeded Bermudagrass

限牧叠播百慕大草

- ✓ Bermudagrass was overseeded with wheat & rye in Trial 1 and wheat, rye, & ryegrass in Trial 2.
  试验1.百慕大草与小麦和黑麦叠播；试验2.与小麦、黑麦及黑麦草叠播
- ✓ Base forage of bermudagrass pasture with *ad libitum* Bermuda/dallisgrass hay:
  基础牧草为放牧百慕大牧草，外加母牛自由采食百慕大/雀稗草干草
  - Graze pasture 2 d/wk (0.2 acre/cow)2天/周放牧（0.2公顷/母牛）
  - Graze pasture 3 d/wk (0.3 acre/cow)3天/周放牧（0.3公顷/母牛）
- ✓ Control cows had bermuda/dallisgrass hay plus a corn gluten feed (CGF; 21% CP) supplement fed at 2.0 lb/cow/d
  对照组除了采食百慕大草和雀稗草外，每头母牛每天添加2磅（0.9公斤）玉米蛋白饲料（21%粗蛋白）
- ✓ Grazed winter pasture beginning in January 6 (Feb./Mar. calving)
  冬季草场放牧始于1月6日（2-3月份为产犊时间）

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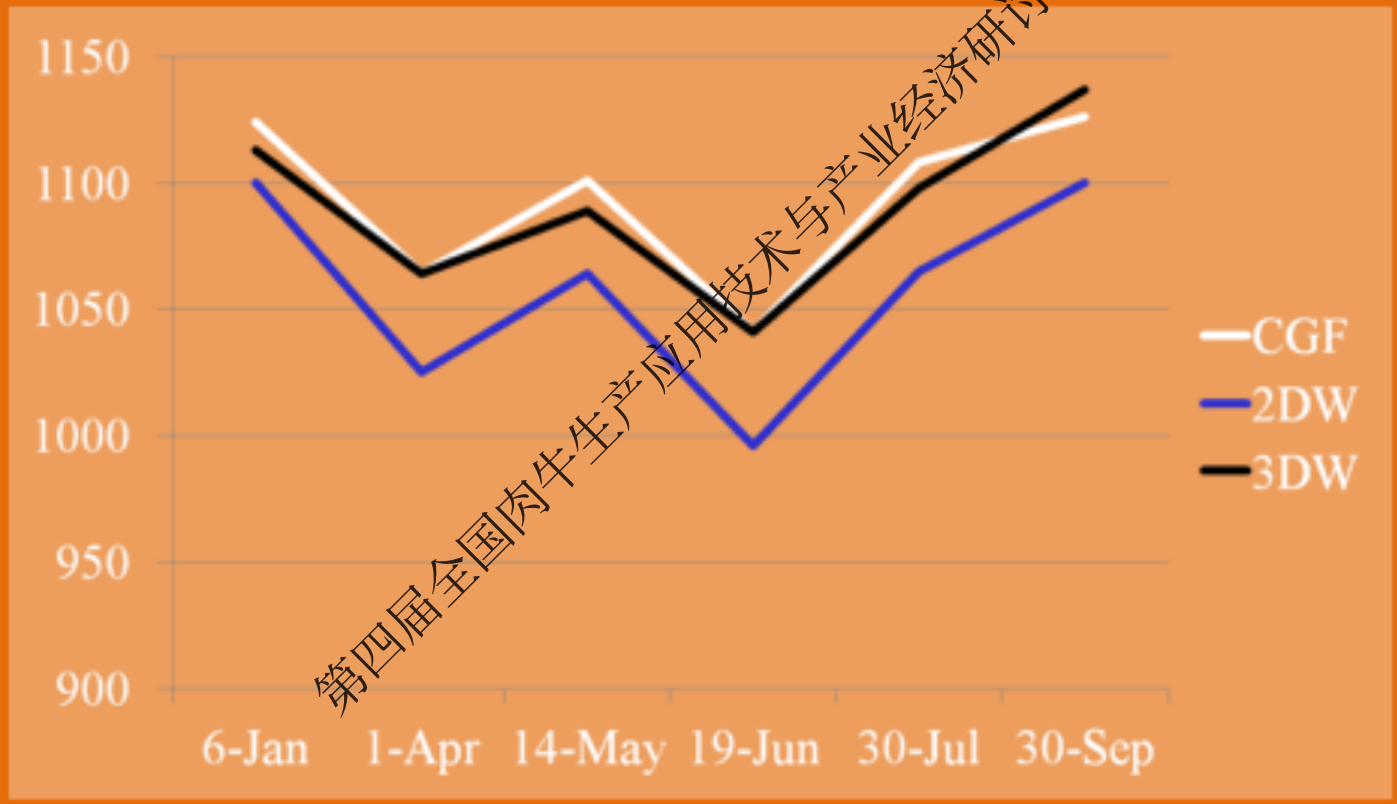
Cow BW Trial 1 母牛体重 试验1

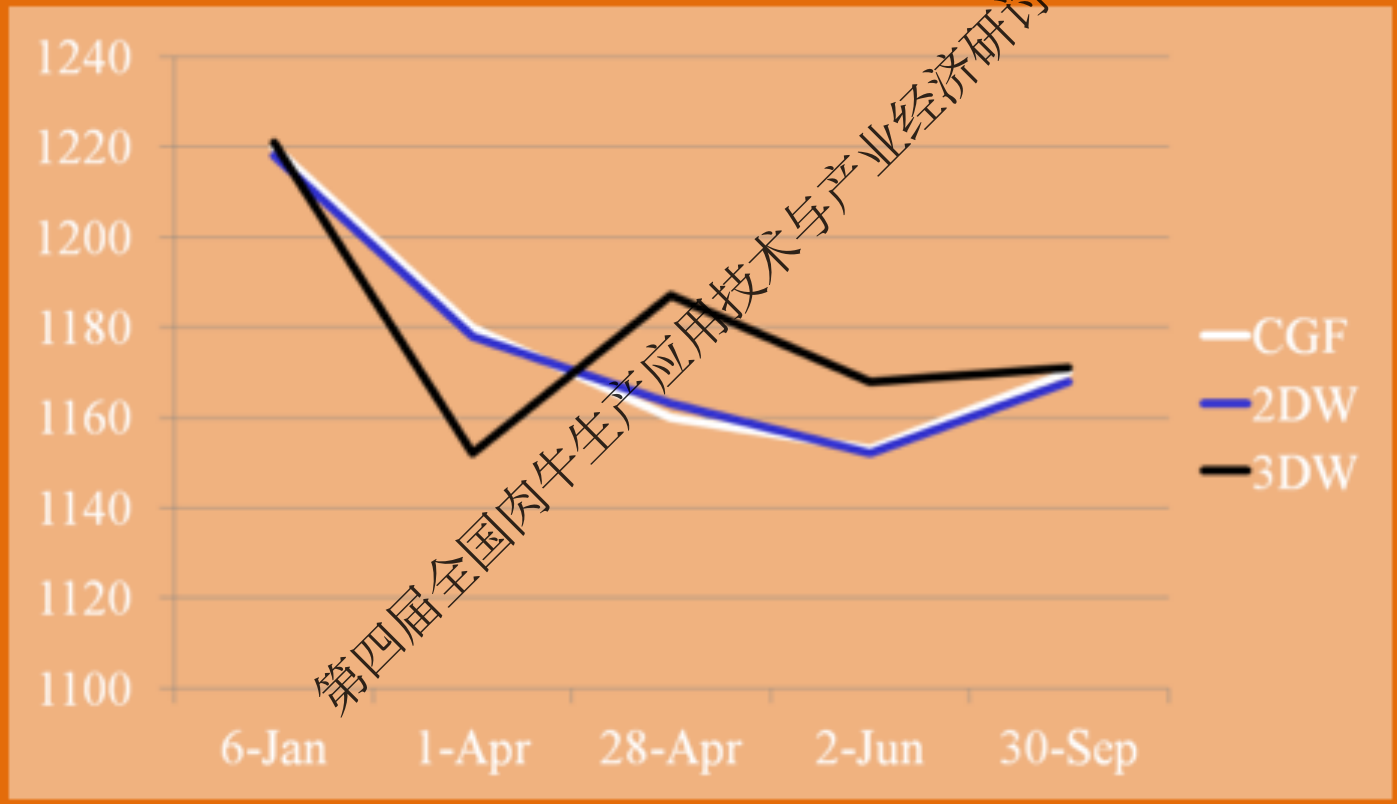


Cow Performance Trial 1

母牛性能　试验1

	CGF	2DW	3DW
Hay intake 干草摄入	26	22	23
Hay reduction 干草减少		13%	12%

Cow BW Trial 2母牛体重 试验2



Cow Performance Trial 2

母牛性能 试验2

	CGF	2DW	3DW
Hay intake 干草摄入	25	22	22
Hay reduction 干草减少		14%	14%

Combining Best Management Practices
结合最佳管理措施

- Research plan developed to answer…
  研究不断深入寻找答案…
  - How BMP's can be fit together to reach winter forage goal.
    如何利用最佳管理达成冬季饲草料的目标
    - Rotational grazing 轮牧
    - Stockpiling bermudagrass 收储百慕大草干草
    - Interseeding cool-season annual grasses 混播一年生冷季牧草
  - How cow stocking rate will impact the 300-day grazing goal
    母牛载畜率对300天放牧目标的影响
  - What will be the effects on economics of cow-calf enterprise?
    对育犊母牛企业经济效益的影响?

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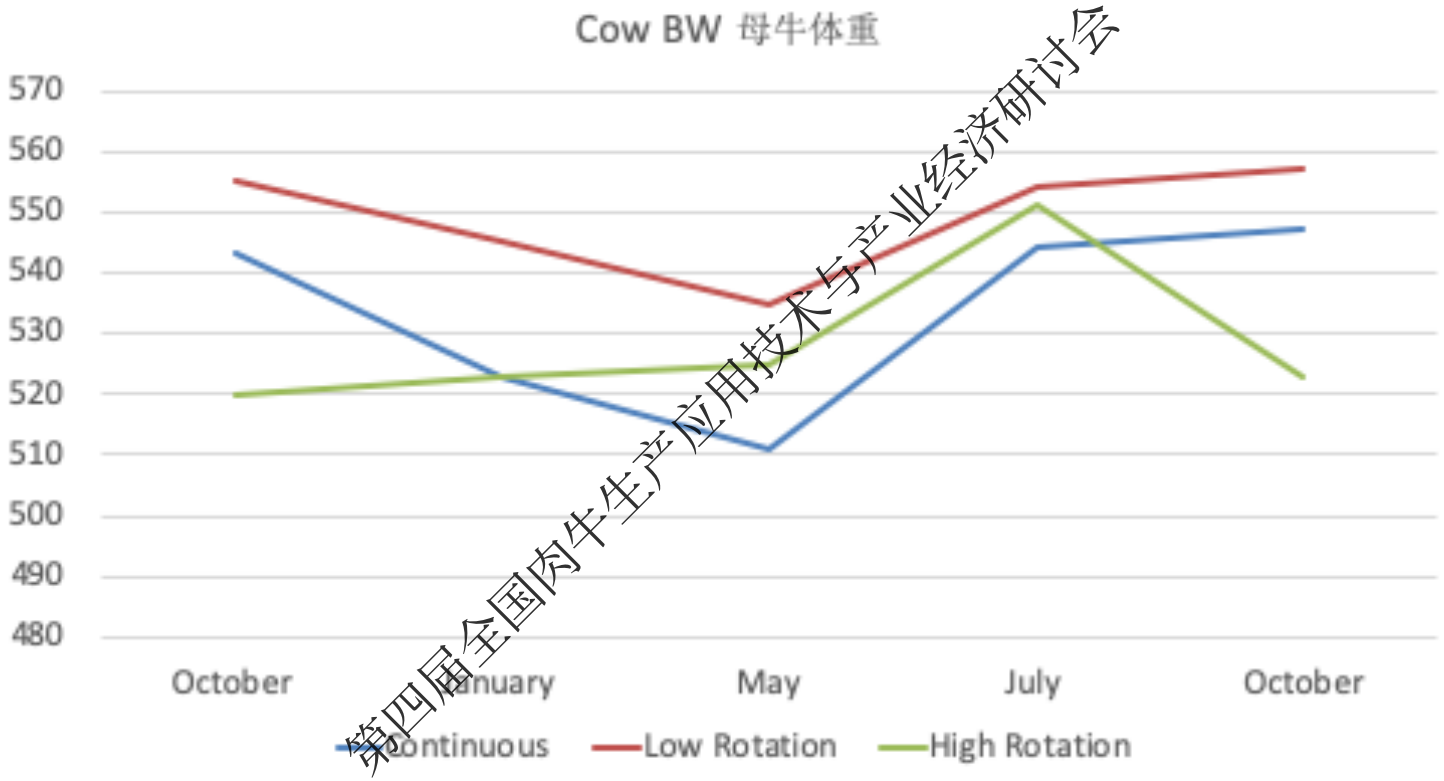
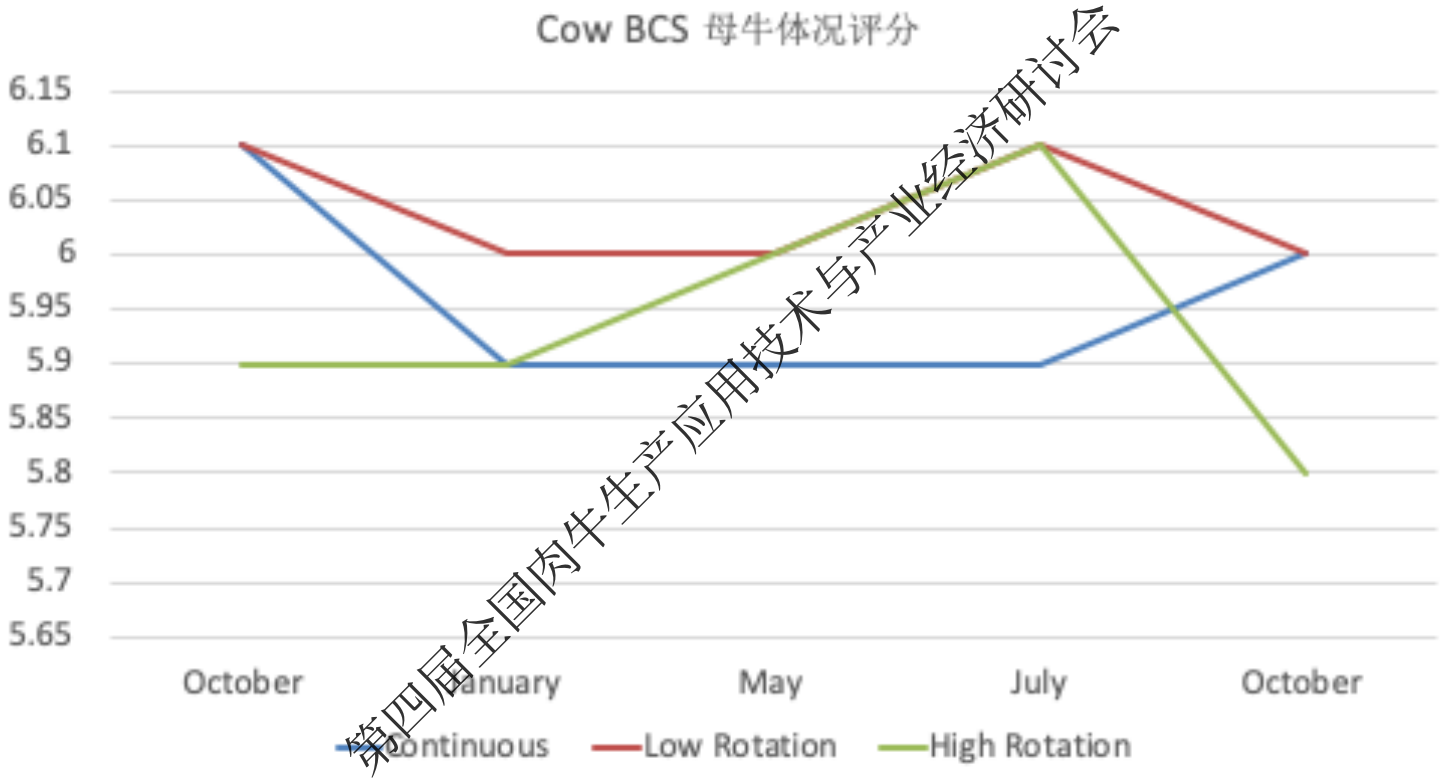
300 Days of Grazing 300天放牧

	Continuous 连续	Low SR Rotation 低载畜率轮牧	High SR Rotation 高载畜率轮牧
Cows per pasture母牛/草场	6	6	12
Stocking Rate, cow/hectare 载畜率，母牛/公顷	1.25	1.25	2.5
Rotational grazing 轮牧	No	Yes	Yes
Stockpiled Bermuda 百慕大草干草储备	No	Yes	Yes
Interseeded CSA grasses 混播一年生冷季牧草	No	Yes	Yes

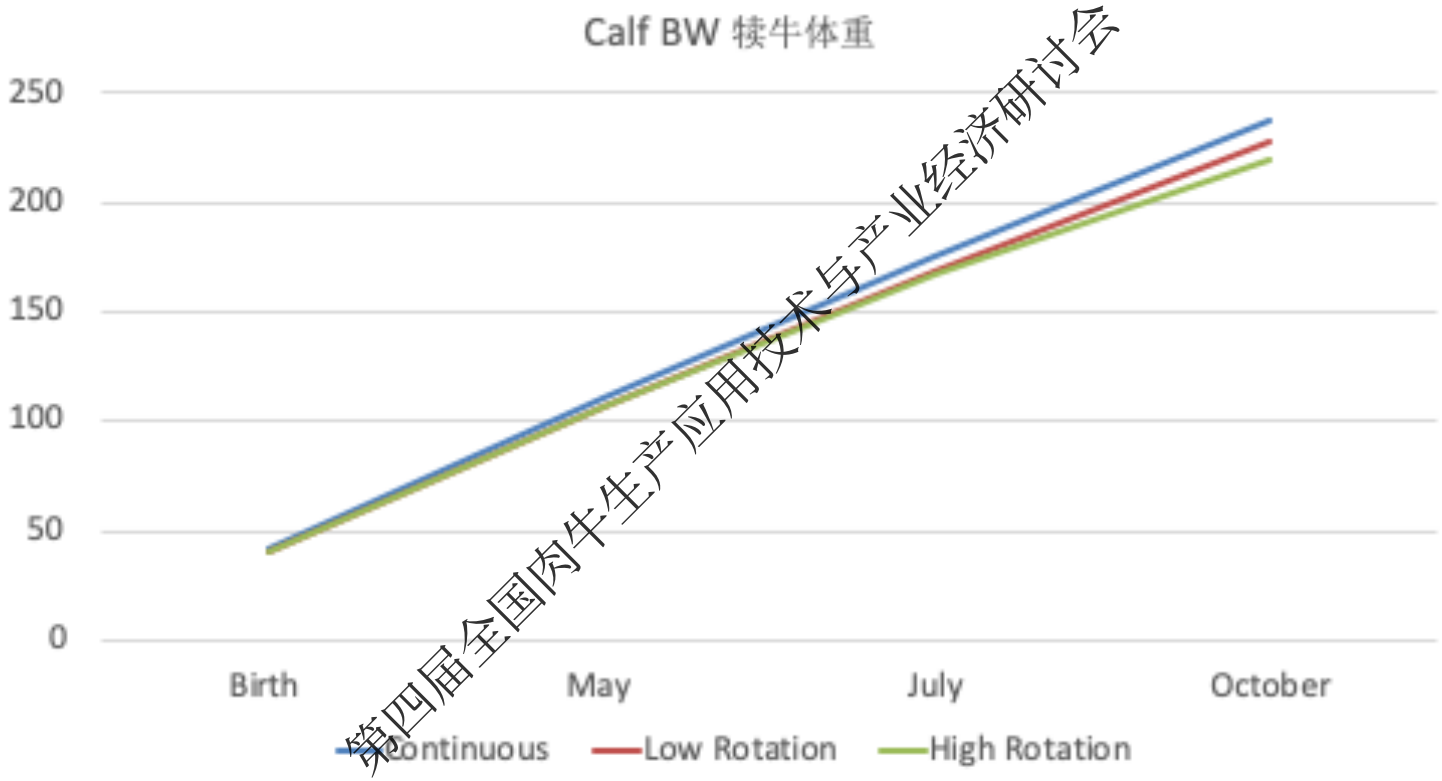
Cow Performance 母牛性能



Cow Performance 母牛性能



Calf Performance 犊牛性能



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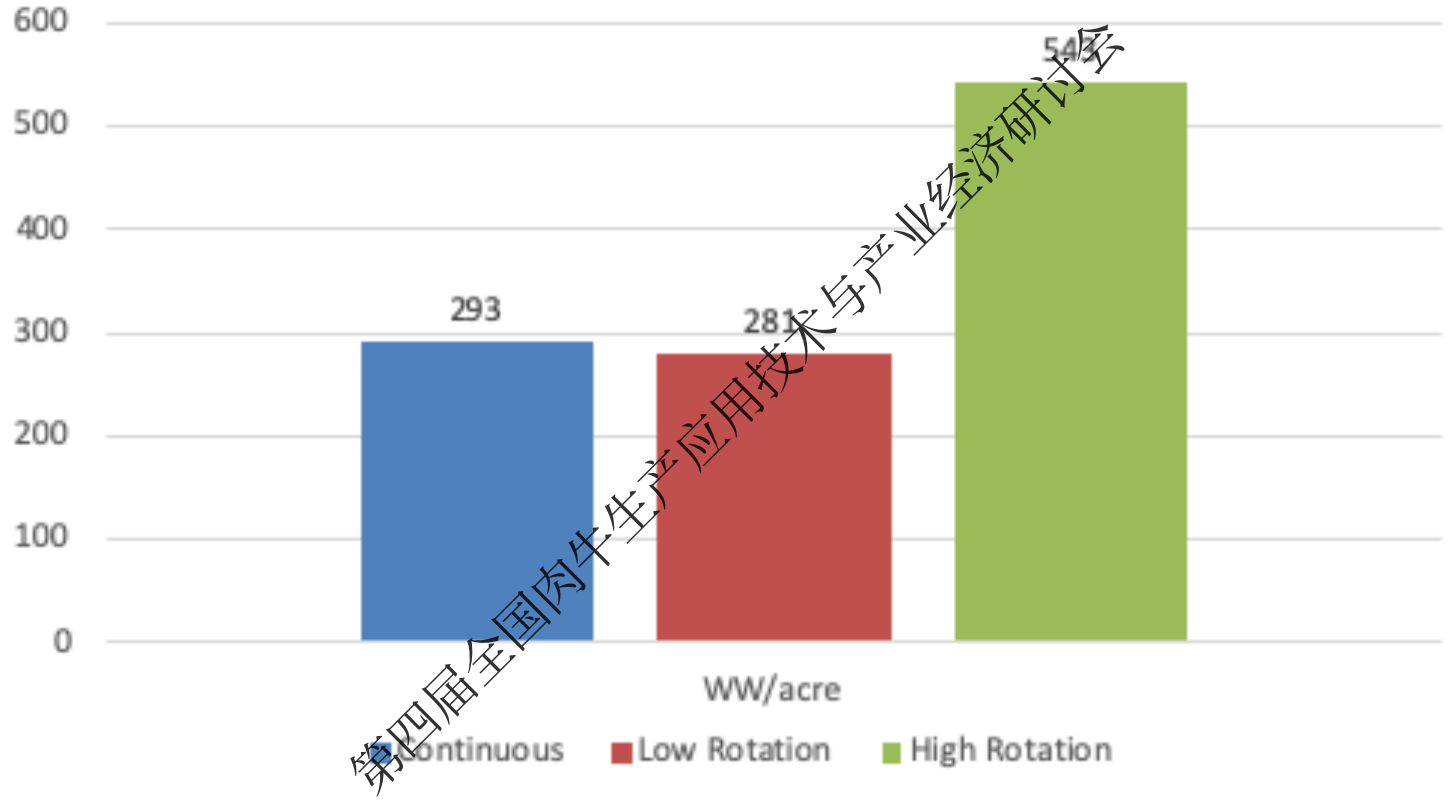
Weaning Weight per Acre 断奶体重/公顷



Economics – Costs 经济效益-成本

	Continuous 连续		Low Rotation 低轮牧		High Rotation 高轮牧	
	$/unit	$/cow	$/unit	$/cow	$/unit	$/cow
	Costs					
Pasture rent 牧场租金	240	40	240	40	240	20
Fertilizer 肥料	405	68	204	34	204	17
Herbicide 除草剂	288	48	288	48	288	24
Mineral 矿物质	137	23	137	23	274	23
Stockpile 干草堆	-	-	45	8	90	8
CSA 冷季牧草		-	451	75	902	75
Hay fed 饲喂干草	750	125	142	24	433	36
Hay harvest 收获干草	-	-	342	57	100	8
Replacement 后备更替	1,047	179	1,047	179	1,284	107
Total	3,570	595	3,360	560	4,956	413

Economics – Returns 经济-回报

	Continuous 连续		Low Rotation 低轮牧		High Rotation 高轮牧	
	$/unit	$/cow	$/unit	$/cow	$/unit	$/cow
		Income				
Calves 犊牛						
Steers, $/kg 阉牛，美元/kg	361		376		383	
Heifers, $/kg 母牛，美元/kg	323		332		337	
	5,136	856	4,884	814	9,564	797
Cull cows, @ repl rate 目前后备率淘汰母牛	1,032	172	1,032	172	1,236	103
Hay 干草	-	-	257	43	76	6
Total Gross, $ 总毛收入	6,168	1,028	6,168	1,029	10,884	907
cost, $ 成本	3,570	595	3,360	560	4,956	413
Net Return 净收益	$2,604	$434	$2,814	469	$5,928	494

What is the difference in hay quality?

干草质量的差异？

Good hay – fertilized crabgrass 14% CP 64%TDN

高品质-施肥后的马唐草，14%粗蛋白，64%总可消化养分

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What is the difference in hay quality?

干草质量的差异？

Bad hay – 'unmanaged' hay meadow 8.9% CP 50% TDN

低品质-未经“管理”的草地草，8.9%粗蛋白，50%总可消化养分

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Class 类	n	CP 粗蛋白	ADF 酸性洗涤纤维	NDF 中性洗涤纤维	TDN 总可消化养分	DMI, % BW 干物质采食量，体重%
Mean	670	11.3	42.6	69.4	54.8	1.7
I	32%	3.0 -16.1 9.2	47.5	74.8	31 - 52 49.2	1.6
II	15%	5.2 – 17.4 10.4	44.3	71.3	52 – 54 52.9	1.7
III	36%	6.5 – 20.9 12.0	40.8	67.9	54 – 59 56.8	1.8
IV	17%	7.4 – 26 14.6	37	59	59 - 72 60.6	2.0

Percentage of Hays Deficient in ....

干草中缺乏...

Nutrient 营养	Dry Cow 干奶牛	Lactating Cow/Growing Calf 哺乳母牛/育犊
Crude Protein 粗蛋白	19%	45%
Total Digestible Nutrients 总可消化养分	31%	83%

Based on 670 hay test results in SW Arkansas

依据西南区阿肯色州670个干草的测试结果

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Producer #1 牧场#1

- Spring calving cowherd (175 head)
  春季产犊母牛群（175头）
  - Average BW = 1,200# 平均体重=1200#
  - Calve March 1 – April 30…60-days (March 15)
    产犊3月01日-60天（最晚3月15日开始）
    - Cows calve in BCS 6 产犊母牛体况评分6
  - Breed May 23 to July 22 3月23日至7月22日配种
  - Feeds hay from mid-Dec to March 15 从12月中旬至3月15日饲喂干草
    - Feeds 0.9 kg of 20% range cubes/cow/day
      每头母牛每天饲喂0.9公斤20%的颗粒料
- 3 hay lots 3处草场
  1. 8.6% CP & 51% TDN 8.6%粗蛋白，51%总可消化养分
  2. 11.2% CP & 53% TDN 11.2%粗蛋白，53%总可消化养分
  3. 10.8 CP & 57% TDN 10.8%粗蛋白，57%总可消化养分

Cow Performance 母牛性能

Mid-Gestation 妊娠中期

- December 15 to 25 12月15-25日
- Feed low quality hay w/ cubes
  饲喂低质量干草及补充料
  - 8.6% CP & 51% TDN
    8.6%的粗蛋白及51%的总可消化养分
- Cow gain BW and BCS
  母牛体重和体况评分增加
  - (0.6 lb/d & 0.1 BCS)
    （0.27公斤/天及0.1的体况评分）

Late Gestation 妊娠末期

- December 25 to March 15
  12月25日-3月15日
- Feed low quality hay w/ cubes
  饲喂低质量干草及补充料
  - Lose about 0.5 BCS 失大约0.5体况评分
  - Calve in BCS 5.5 产犊时体况评分5.5
- Feed mid quality hay w/ cubes
  饲喂中等质量干草及补充料
  - Cows maintain BCS 母牛维持体况评分
- Cows will cycle to rebreed in 50-days with 95% conception.
  母牛可以在产后50天内发情配种，怀孕率95%

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Producer #2 牧场#2

- Fall calving cowherd (50-head)
  秋季产犊母牛群（50头）
  - Average BW = 1,350# 平均体重=1350#
  - Calve October 1 to December 15…75-days (Nov 3)
    产犊日期从10月1日…75天（11月3日）
    - Cows calve in BCS 6.5 母牛产犊时体况评分6.5
  - Breed - December 22 to March 7 12月22日至3月07日配种
  - Feeds hay from November 15 to April 15 11月15日到4月15日饲喂干草
  - Feeds 2.7 kg of blended byproduct feeds 3-4 days per week
    2.7公斤混合副产品饲料，每周饲喂3-4天
- Says he has "average" quality hay 干草质量"一般"
  - We divided into 4 hay lots 我们分为4处草场

1. Purchased from neighbor 7.9% CP & 48% TDN 邻居购入，7.9%粗蛋白，48%总可消化养分
2. 1st cutting in Barn 13.1% CP & 56% TDN第1茬牛舍附近收割，13.1%粗蛋白，56%总可消化养分
3. 2nd cutting outside 12.4%CP & 59% TDN第2茬在外围收割，12.4%粗蛋白，59%总可消化养分
4. 3rd cutting (in field) 11.1% CP & 54% TDN第3茬在（牧场）收割，11.1%粗蛋白，54%总可消化养分

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Cow Performance母牛性能

Early Lactation 泌乳早期

- November 15 to January 18
  11月15日到1月18日
- Feed Best quality hay 1st
  首先饲喂质量最好的牧草
  - Last until December 10
    饲喂直到12月10日
  - 12.4% CP & 59% TDN
    12.4%粗蛋白，59%总可消化养分
  - Cow gain BW and BCS
    母牛的体重和体况评分增加
- Feed Barn hay next
  随后饲喂牛圈附近收割干草
  - Last until Jan 31 持续到1月31日
  - Cows maintain BCS
    母牛维持体况评分

Late Lactation 泌乳晚期

- January 18 to April 15 1月18日到4月15日
- Feed last cutting饲喂最后收割的牧草
  - Last until Mar 1持续到3月1日
  - Cows maintain BCS母牛维持体况评分
- Feed purchased hay饲喂购入的干草
  - Cows lose 0.6 BCS 母牛体况评分下降0.6
  - Protein inadequate 蛋白质不足

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What to do with lowest quality hay?

如何处理品质最低的干草？

Increase supplementation?增加补充料？

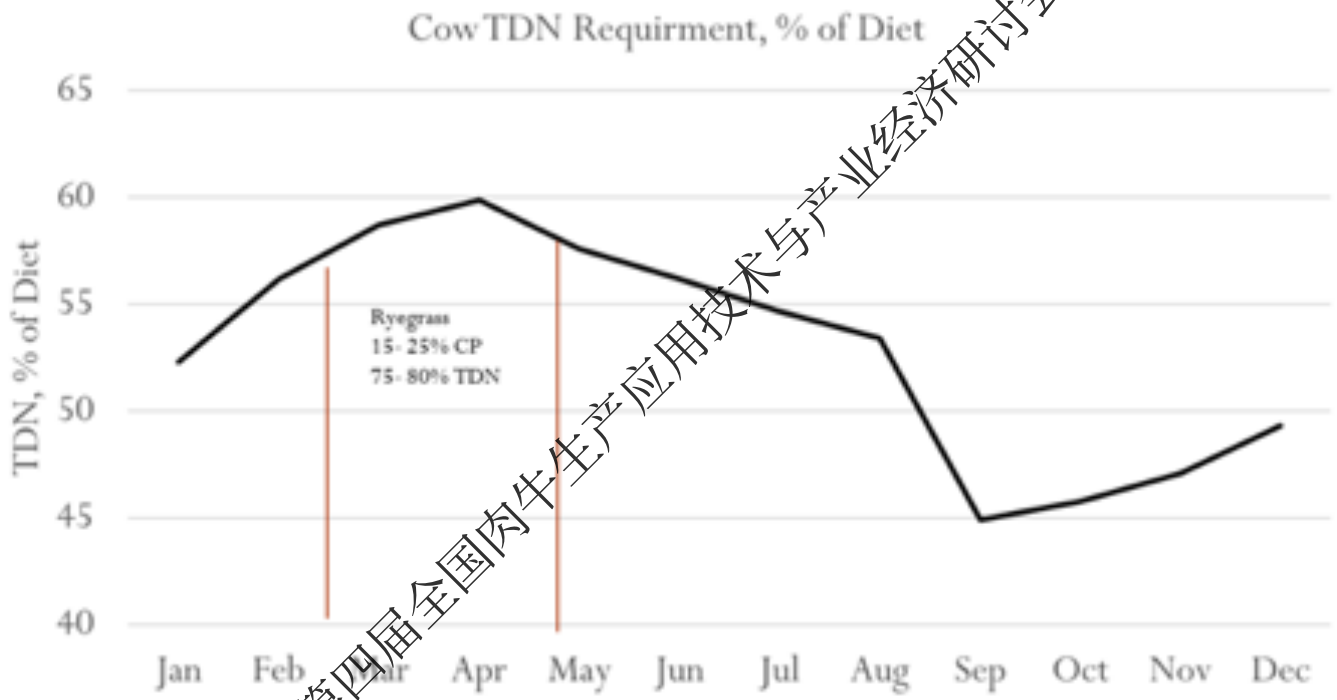
- Need to feed 4 kg of supplement to maintain BW and BCS
  需要4公斤补充料来维持体重和体况评分
- Cows are over-conditioned so some BCS loss can be tolerated
  如果母牛体况过肥，一些体况评分损失也是允许的

Utilize ryegrass 利用黑麦草

- 6 lbs DM would meet cow requirement
  2.72公斤干物质即满足母牛的需要

Annual Cow Nutrient Requirements

母牛一年的营养需要变化



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A final word 结语

- Economics require efficiency in hay feeding to reduce waste
  从经济角度考虑需要提高干草饲喂效率以减少浪费

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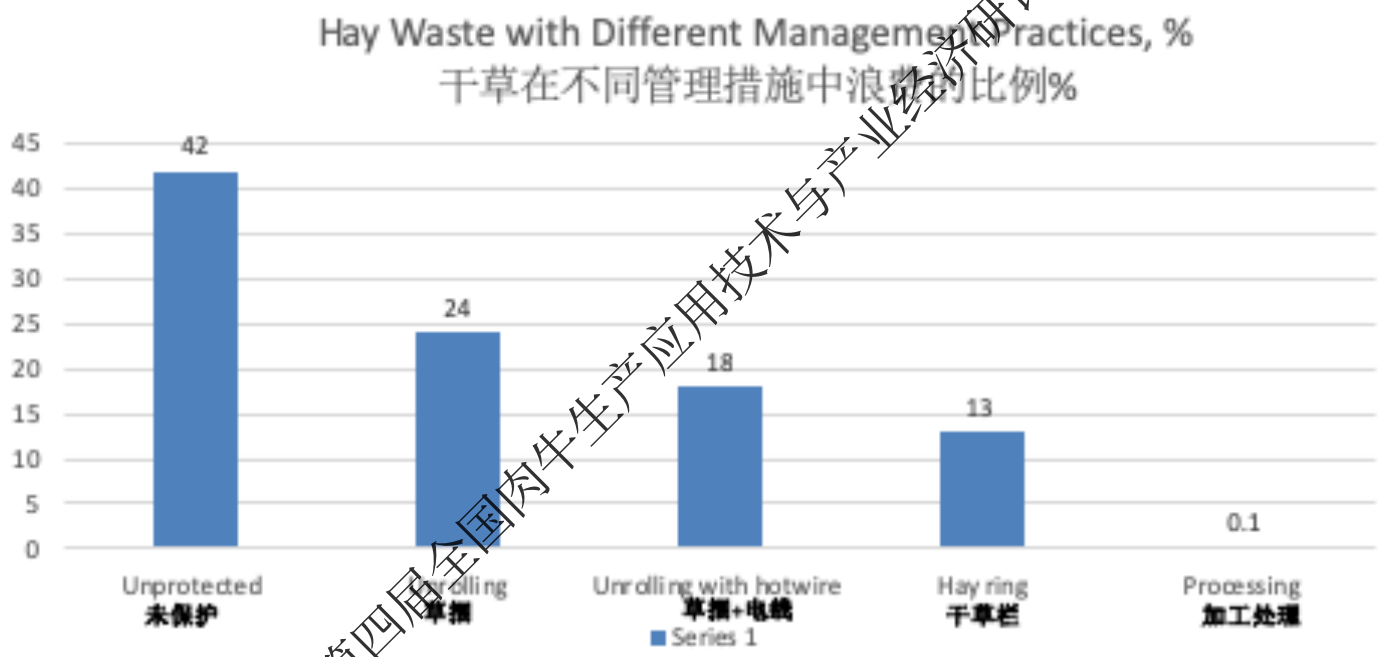
Hay Feeding Management and Hay Waste干草饲喂管理和干草浪费



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第四届全国肉牛生产应用技术与产业经济研讨会