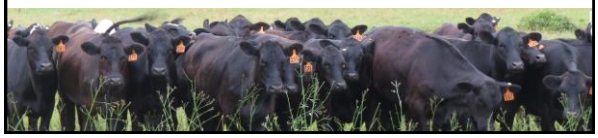
TEXAS TECH UNIVERSITY
Department of Animal & Food Sciences

Supplementation: How, What, When

Darren D. Henry



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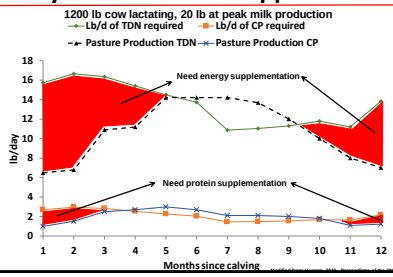
Why do we need to supplement?



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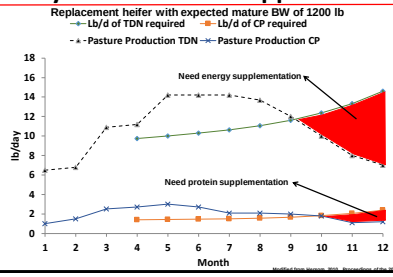
Why do we need to supplement?



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Grain vs. byproducts

- We need to consider…

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Evaluating costs

- Calculating the cost per lb of nutrient provided:

- $/lb of nutrient = $\left[\frac{\$/ton}{2{,}000}\right] \div \left[\frac{\%\ DM}{100} \times \frac{\%\ nutrient\ (CP\ or\ TDN)}{100}\right]$

Corn gluten feed pellets

$155/ton
90% DM
80% TDN
22 % CP

$/lb of TDN = (155/2000) / [(90/100) x (80% TDN/100)] = $0.108/lb of TDN

$/lb of CP = (155/2000) / [(90/100 x 22% CP/100)] = $0.354/lb of CP

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Nutrient costs of common feedstuffs

	$/ton	$/lb of TDN	$/lb of CP
Corn gluten fed pellets	155	0.11	0.35
Soybean hull pellets	144	0.10	0.67
Cotton burrs (Gin residue)	35	0.04	0.17
DDG (dry distillers grain)	152	0.09	0.30
Bermudagrass (T85) hay	120	0.12	0.65

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Costs

- Lets consider some of our costs…

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Cost of loss

Daily hay DM	Placement		Processing		SE	P-values		
	Pen surface	Structure	Whole	Processed		Placement	Processing	Interaction
Offered, lb/cow	29.3	27.4	29.1	27.7				
Waste, lb/cow	4.4	1.2	3.3	2.3	0.2	< 0.01	0.09	0.79
Waste, %	19.1%	4.6%	13.6%	10.1%	2.2%	<0.01	0.26	0.60
Intake, lb/cow	24.9	26.2	25.8	25.4	1.1	0.33	0.70	0.50
Intake cow BW	1.9%	2.0%	1.9%	1.9%	0.1%	0.33	0.70	0.40

DiCostanzo and Jaderborg (2015) University of Minnesota

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Cost of loss

- Placing hay in a structure can save 14.5% of hay DMI needs
  - A 100-cow herd needing 3,150 lb DM/cow in 120 d can save 45,675 lb DM
  - $1,881 annually
- Cumulative losses
  - Storage = 9%
  - No feeder = 14.5%
  - Total = 23.5%

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Cost of loss

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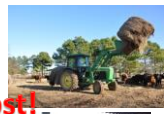
Other costs

- The one component we often forget when estimating cost:



Labor cost!

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Take home message #1

Do not forget to account for costs such as loss and labor

Considerations before buying

- Each individual feedstuff has positive and negative attributes
- It is important to consider:
  - Protein
  - Energy (TDN)
- Need to evaluate other contents as well:
  - Fat, %
  - Sulfur, %
  - Phosphorus, %
    - Ca:P – 1.5:1 to 4:1

Corn gluten feed (CGF)

- Corn byproduct
  - Wet milling of corn
  - Residue after removal of starch, germ, and gluten
- Widely utilized in US
- Relatively high in CP and energy (20 to 25% CP; 37% NDF; 80% TDN)
- Readily digestible fiber in wet CGF
  - Can reduce the risk of acidosis in cattle being fed step-up diets

Corn gluten feed

- Supplementing corn vs CGF with alfalfa haylage
- 70 crossbred steers
- Replaced 20 or 60% haylage

	Alfalfa haylage	Corn	CGF
DM, %	64.0	89.2	91.9
OM, % DM	92.2	98.0	92.5
NDF, % DM	58.4	8.5	40.5
ADF, % DM	35.0	2.4	8.1
CP, % DM	13.0	9.1	14.9

Hannah et al. (1990) University of Missouri

Corn gluten feed

Corn vs. CGF

		% Corn		% CGF		*P*-value	
	Alfalfa haylage	20	60	20	60	Haylage vs. supp	Corn vs. CGF
Initial BW, lb	782	780	780	778	780		
Final BW, lb	994	1027	1113	1038	1091		
DMI, lb/d	23.4	23.8	27.8	24.5	26.7	<0.05	<0.05
ADG, lb	2.4	2.9	4.0	3.1	3.7	<0.05	<0.05
Feed:gain	9.3	8.1	7.0	7.9	7.2	<0.05	<0.10

Distillers grains

- Corn and sorghum byproduct of ethanol industry
- Widely utilized in US, especially the Midwest
- Relatively good protein source (28 to 33% CP), but is a great energy source (85 to 95% TDN)
- For every 100 lb of corn processed, about 33 lb of distillers is produced

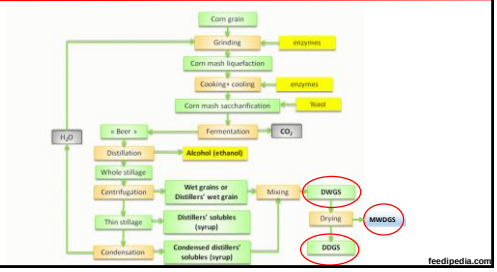
Distillers grains

- Many different options:
  - Dried distillers grains (DDG)
  - Modified distillers grains (MDG)
  - Wet distillers grains (WDG)
  - DDG + distillers' solubles (DDGS)
  - MDG + distillers' solubles (MDGS)
  - WDG + distillers' solubles (WDGS)
- Highly variable sulfur content (0.2 – 1.2% DM)
  - Varies not only between distilleries, but also within

Possible issues with trace mineral absorption and polioencephalomalacia

NASEM (2016) → 0.5% for grazing cattle and 0.3% for grain-fed cattle

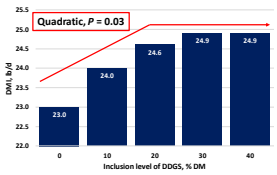
Distillers grains



Distillers grains

- Summary of Nebraska feedlot data
- DDGS replaced corn in diets
- 66 pens and 581

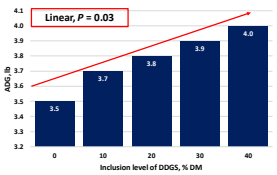
DMI of feedlot cattle consuming DDGS



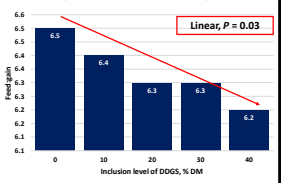
Bremer (2011) University of Nebraska

Distillers grains

ADG of feedlot cattle consuming DDGS



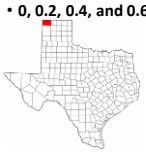
Feed:gain of feedlot cattle consuming DDGS

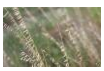


Bremer (2011) University of Nebraska

Distillers grains

- 132 English crossbred steers (initial BW = 481 ± 15 lb) grazing native west Texas range (sideoats grama, bluegrama, bluestem and buffalograss)
- Steers were supplemented with increasing levels of DDGS
- 0, 0.2, 0.4, and 0.6% of BW





Sideoats

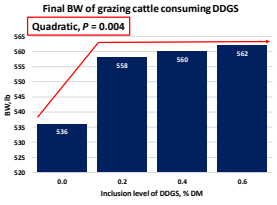
Bluegrama

Bluestem

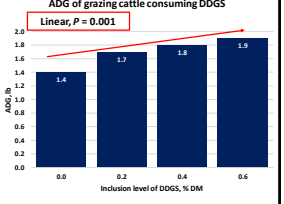
Buffalograss

Distillers grains

Final BW of grazing cattle consuming DDGS



ADG of grazing cattle consuming DDGS



Soybean hulls (SH)

- Byproduct of soybean meal and oil production
- High-energy fiber source (12% CP; 65% ADF; 77% TDN)
- Replace portions of hay during winter
- Largely found in pelleted form
  - Limited effective fiber
  - Beware of acidosis

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Soybean hulls

- Replacing forage with SH for limit-fed growing cattle
- 300 Crossbred heifers

Ingredient, % DM	2.75% of BW Hay-based	1.5 or 2.25% of BW Corn-based	1.5 or 2.25% of BW SH-based
Soybean hulls	-	-	91.6
Dry-rolled corn	29.3	76.6	-
Alfalfa hay	45.0	15.0	-
Prairie hay	20.0	-	-
Cane molasses	5.0	4.0	3.1
Soybean meal	-	1.4	-

Loest et al. (2001) Kansas State University

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Soybean hulls

SH replacing hay in limit-fed heifers

	Treatment					*P*-value
	Hay	Corn1.5	Corn2.25	SH1.5	SH2.25	Hay vs. SH
Initial BW, lb	560	584	573	569	576	
Final BW, lb	736	695	800	646	739	<0.05
DMI, lb/d	16.8	9.3	14.4	9.1	13.7	<0.05
ADG, lb	1.8	1.1	2.3	0.8	1.7	<0.05
Feed:gain	9.3	8.2	6.1	11.2	8.3	>0.10

- Heifers consuming the hay-based diet had greater gains; however:
  - Cattle on SH-based diets consumed less
  - F:G did not differ between hay- and SH-based diets

Loest et al. (2001) Kansas State University

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Molasses

- Byproduct of the sugar industry
- Provided to cattle for decades
- Multiple purposes:
  - Binding agent
  - Carrier
  - Palatability
- 30 to 45% sugar; 6% CP; sulfur content varies

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Molasses

feedipedia.com

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Molasses

- Increases in OM digestibility (Royes et al., 2001; Kalmbacher et al., 1995)
- Decreases fiber digestibility (Royes et al., 2001; Kalmbacher et al., 1995)
- No effect on DMI of hay (Royes et al., 2001)
- Increases ADG and Gain:feed (Royes et al., 2001)

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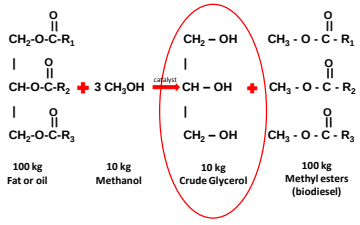
Crude glycerol

- Byproduct of bio-diesel industry
- Recent research on replacing corn in high-concentrate diets
- Source of energy (81% TDN)
- Potential to decrease cost of liquid feeds without negative effects

Biodiesel production

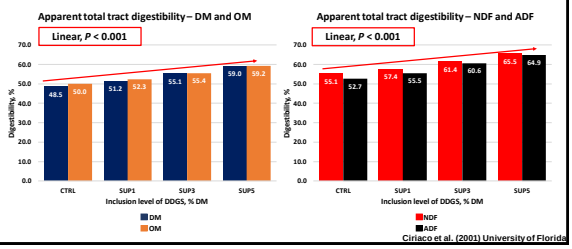


Van Gerpen et al., 2005

50:50 molasses:glycerol

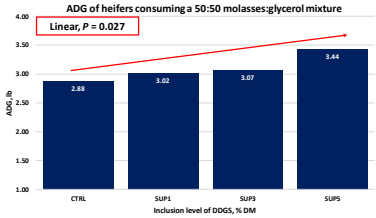
- 24 crossbred heifers (BW 838 ± 68 lb)
- Housed in the UF – Feed Efficiency Facility in Marianna, FL
- Four treatments:
  - CTRL: T85 bermudagrass hay (12% CP, 55% TDN)
  - SUP1: hay + 1 lb/d of 50:50 mixture
  - SUP3: hay + 3 lb/d of 50:50 mixture
  - SUP5: hay + 5 lb/d of 50:50 mixture

50:50 molasses:glycerol



Ciriaco et al. (2001) University of Florida

50:50 molasses:glycerol



Ciriaco et al. (2001) University of Florida

50:50 molasses:glycerol

- $220/ton for mol:gly blend and $100/ton of hay – 12 lb of hay DMI
  - Cost of supplementation for 5 lb/d = $0.55/d

CTL treatment FCOG = 0.60/2.88 = $0.21/lb

5 lb/d treatment FCOG = 1.15/3.43 = $0.33/lb

In 90 d = $10.8/hd added feed costs

Added wt gain in 90 d = 49.5 lb/hd
49.5 lb x $1.50/lb = $74.25/hd extra

Take home message #2

Maybe it is time to start considering feed as an investment rather than just a cost

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Other potential byproducts

- Whole cottonseed
  - 23% CP
  - 93% TDN
  - ↑ P content
  - Beware of gossypol
- Citrus pulp
  - 7% CP
  - 82% TDN
- Peanut hulls
  - 8% CP
  - 25% TDN
  - Beware of ground peanut hulls
- Gin residue
  - 8% CP
  - 45% TDN

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UF IFAS UNIVERSITY of FLORIDA

UF Hay Balancer

- Simple Excel based tool to aid producers in providing the correct amount of energy and protein for their herd
- The following slides include step-by-step information on how to utilize the Hay Balancer
- Step 1: Download the "UF Hay Balancer"
  - http://nwdistrict.ifas.ufl.edu/phag/2018/02/23/introducing-the-new-uf-hay-balancer-decision-aid-for-cattle-ranchers/

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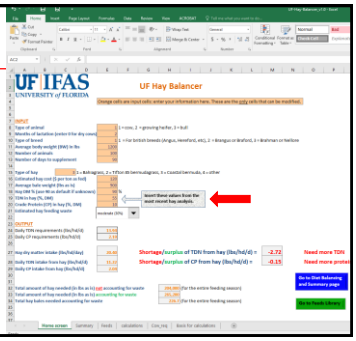
Step 2: At the "Home screen" tab, enter all your inputs. For example: average cow weight, whether she is lactating or not, type of hay to use, and more importantly, a current hay analysis. See image below for information on where to enter that information.



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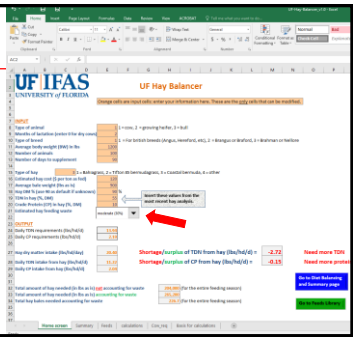
Step 3: Select the estimated hay-feeding waste from the drop-down menu. You have the option of selecting: None (0%) for a situation without any waste, low (10%) – such as a hay trailer or sheeted bottom hay ring, moderate 30% open bottom hay ring, or high (50%), if hay is fed on the ground without a hay feeder.



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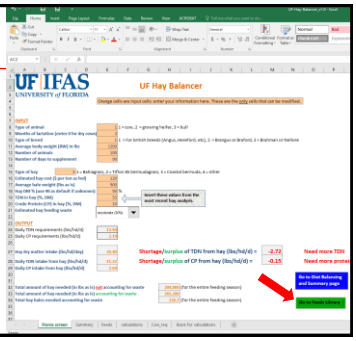
Step 4: Click the green button to go to the feeds library to check for accuracy on feedstuff information such as prices or nutrient composition. Alternatively, the user can click the blue button to go directly to the Balancing and Summary page.



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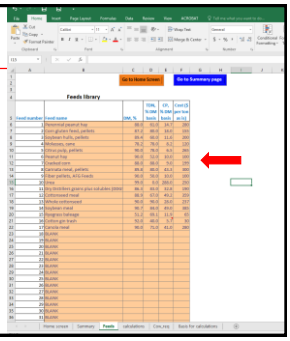
Step 5: In the Feeds Library tab, new feeds can be added or modified, changing price and nutrient composition to fit the most current analysis or price quote. Any orange cells can be modified.



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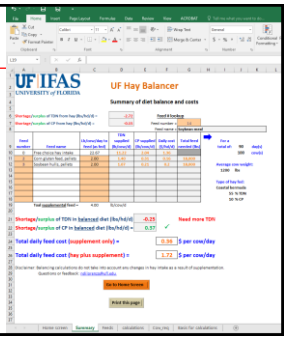
Step 6: On the Summary tab, the user can enter the amounts of feed to supplement and the program automatically calculates nutrient shortage or surplus. When either TDN or CP are needed in order to meet the cow's requirements, a red sign will display indicating "Need more TDN" or "Need more CP".



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Take home message #3

Use the tools available to you to provide your cows with the resources to meet their genetic potential

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Thank you

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