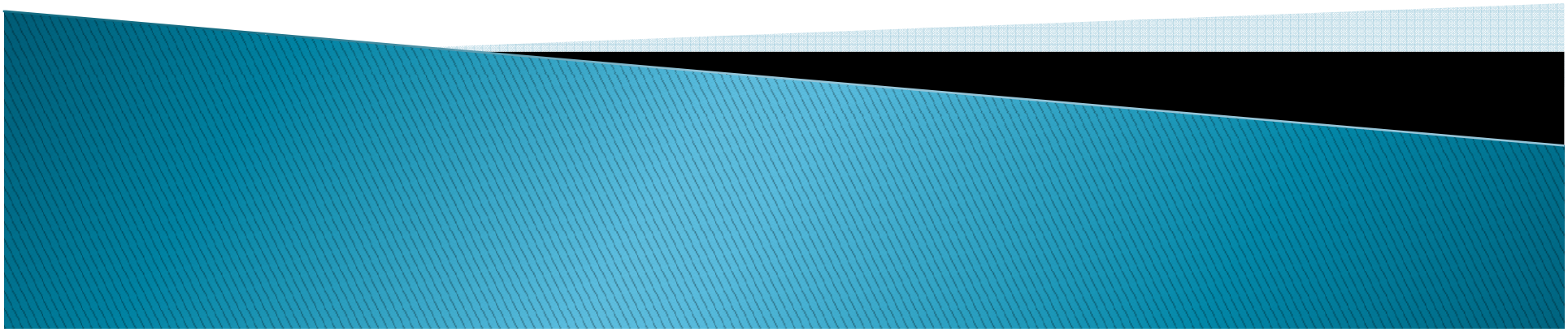
Optimizing Income Over Feed Supplement Cost

Victor E. Cabrera

Ohio Dairy Health and Management Certificate Program
Module #5 – Dairy Cattle Economics, February 4-5, 2010



Introduction

- Large fluctuations in milk and supplemental feed prices create anxiety and uncertainty
  - More than 90% of dairy farm income comes from the milk
  - More than 40% of variable expenses are supplemental feed
  - Correct decisions about income over feed supplement cost (IOFSC) have a large influence on dairy farm profitability
- Important to make correct decisions to maximize IOFSC

Justification

- Surface responses to IOFSC for levels of crude protein (CP) have been studied in the past
- However, there are further needs to more detailed CP components responses to milk productivity
  - Rumen Undegradable Protein (RUP)
  - Rumen Degradable Protein (RDP)
- There is an opportunity to fine-tune the supplementation to maximize IOFSC

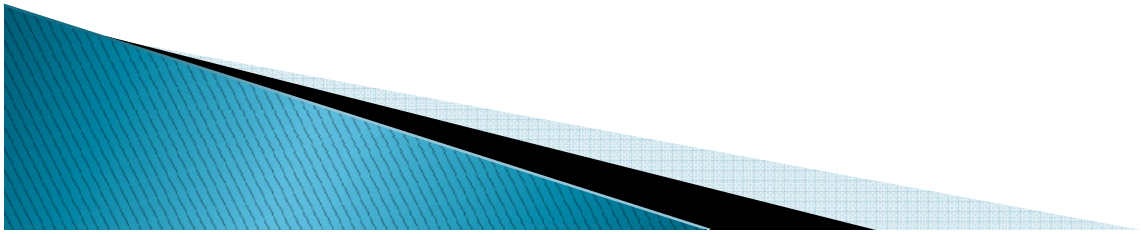
Justification

- Traditional diet formulation is based on finding the least cost ration for a target level of nutrients for a desired level of milk production

- Typically, traditionally diet formulation does not consider changes in milk production due to dynamic changes on CP, RUP, RDP that could be fine-tuned to maximize IOFSC

Justification

- Profitability of dairy farms can be improved by decreasing CP and adjusting RUP and RDP through a better selection of ingredients
- Lower CP diets decrease N excretion and consequently environmental impacts
- Not available user-friendly decision support systems to perform this kind of optimization



UW Extension THE UNIVERSITY of WISCONSIN MADISON

Objective

- Present a simple framework to optimize IOFSC
- Perform some case studies
- Implement the optimization model into user-friendly decision support system
- Hands-on practice in the use of the IOFSC optimization model

Framework

- Objective = $\max(MV - \sum_{i=1}^{N} SV_i)$
- Subject to $\sum_{i=1}^{N} SQ_i$ = DMI
  - RUP≤max RUP, RDP≤max RDP, SQ≤max SQ
- DMI = Using NRC, 2001
- MP = Using NRC

Framework

Feed Stuff	A (%)	B (%)	C (%)	Kd	Calculated Kp	Calculated RUP (%)	Calculated RDP (%)	Calculated CP (%)
Forages								
35-Corn silage	51.00	30.20	18.80	4.40	5.93	3.15	5.62	8.80
74-Mixed silage	58.10	34.20	7.70	10.40	5.93	3.82	15.18	19.00
83-Alfalfa silage	57.30	35.30	7.40	12.20	5.93	4.15	17.75	21.90
Energy Supplements								
27-Corn grain	23.90	72.5	3.60	4.90	8.34	4.63	4.77	9.40
8-Barley grain	30.20	61.20	8.60	22.70	8.34	3.11	9.29	12.40
Protein Supplements								
106-Soybean meal	22.50	76.80	0.70	9.40	8.34	18.37	31.53	49.90
25-Corn gluten meal	3.90	90.90	5.20	2.30	8.34	49.69	15.31	65.00
23-Corn distiller grains	28.50	63.30	8.20	3.60	8.34	15.57	14.13	29.70
104-Soybean meal expellers	8.70	91.30	0.00	2.40	8.34	32.83	13.47	46.30

A Case Example

	Value
Herd	Holstein
DIM	100 d
Production	80 lb/d
DMI	53.67 lb/d
Forage proportion of DMI	50%
Forage CP, RUP, RDP	7.7%, 1.8%, 5.9%
Target CP, RUP, RDP	18%, 6.5%, 11.5%

A Case Example

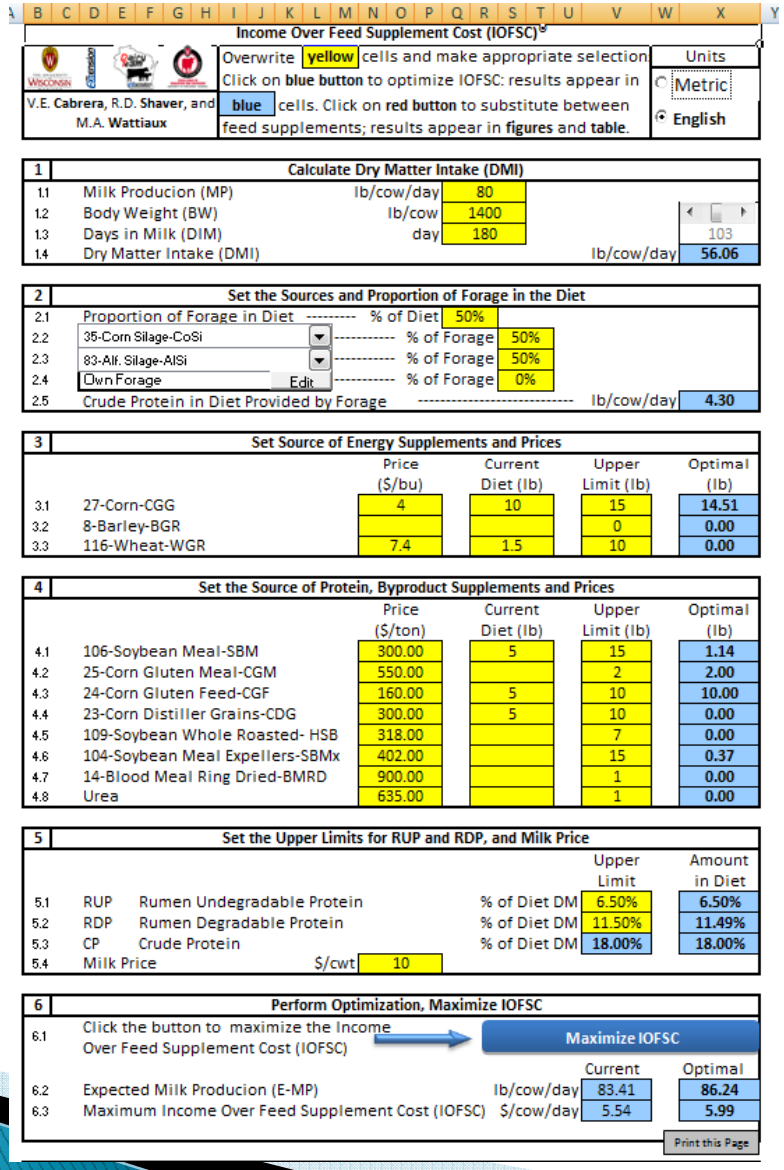
	Current	Optimized
Corn grain	20.9 lb	17.6 lb
Soybean meal	6.0 lb	4.2 lb
Corn distillers	0.0 lb	5.0 lb
IOFSC	$5.20	$5.54

- $0.34/d per cow
  - $124/yr per cow
    - $12,400/yr per 100-cow farm

Data for IOFSC Optimization

Feed Stuff	Price		Upper Limit		Current in Diet	
Energy Supplements	**$/kg**	**$/bu**	**kg**	**lb**	**kg**	**lb**
27-Corn grain	0.16	4.0	6.81	15	4.54	10
Wheat grain	0.27	7.4	4.54	10	0.68	1.5
Protein Supplements	**$/kg**	**$/ton**	**kg**	**lb**	**kg**	**lb**
106-Soybean meal	0.28	250	6.81	15	2.27	5
25-Corn gluten meal	0.61	550	0.91	2		
24-Corn gluten feed	0.18	160	4.54	10	2.27	5
23-Corn distiller grains	0.22	200	4.54	10	2.27	5
104-Soybean meal expellers	0.20	402	6.81	15		
14-Blood meal ring dried	0.99	900	0.45	1		
Urea	0.70	635	0.45	1		

Spreadsheet Application



Income Over Feed Supplement Cost (IOFSC)

V.E. Cabrera, R.D. Shaver, and M.A. Wattiaux

Overwrite **yellow** cells and make appropriate selection
Click on **blue button** to optimize IOFSC: results appear in **blue** cells. Click on **red button** to substitute between feed supplements; results appear in **figures** and **table**.

Units: ○ Metric ◉ English

1 Calculate Dry Matter Intake (DMI)

1.1	Milk Producion (MP)	lb/cow/day	80	
1.2	Body Weight (BW)	lb/cow	1400	
1.3	Days in Milk (DIM)	day	180	103
1.4	Dry Matter Intake (DMI)			lb/cow/day 56.06

2 Set the Sources and Proportion of Forage in the Diet

2.1	Proportion of Forage in Diet	% of Diet	50%
2.2	35-Corn Silage-CoSi	% of Forage	50%
2.3	83-Alf. Silage-AlSi	% of Forage	50%
2.4	Own Forage [Edit]	% of Forage	0%
2.5	Crude Protein in Diet Provided by Forage		lb/cow/day 4.30

3 Set Source of Energy Supplements and Prices

		Price ($/bu)	Current Diet (lb)	Upper Limit (lb)	Optimal (lb)
3.1	27-Corn-CGG	4	10	15	14.51
3.2	8-Barley-BGR			0	0.00
3.3	116-Wheat-WGR	7.4	1.5	10	0.00

4 Set the Source of Protein, Byproduct Supplements and Prices

		Price ($/ton)	Current Diet (lb)	Upper Limit (lb)	Optimal (lb)
4.1	106-Soybean Meal-SBM	300.00	5	15	1.14
4.2	25-Corn Gluten Meal-CGM	550.00		2	2.00
4.3	24-Corn Gluten Feed-CGF	160.00	5	10	10.00
4.4	23-Corn Distiller Grains-CDG	300.00	5	10	0.00
4.5	109-Soybean Whole Roasted- HSB	318.00		7	0.00
4.6	104-Soybean Meal Expellers-SBMx	402.00		15	0.37
4.7	14-Blood Meal Ring Dried-BMRD	900.00		1	0.00
4.8	Urea	635.00		1	0.00

5 Set the Upper Limits for RUP and RDP, and Milk Price

				Upper Limit	Amount in Diet
5.1	RUP	Rumen Undegradable Protein	% of Diet DM	6.50%	6.50%
5.2	RDP	Rumen Degradable Protein	% of Diet DM	11.50%	11.49%
5.3	CP	Crude Protein	% of Diet DM	18.00%	18.00%
5.4	Milk Price		$/cwt 10		

6 Perform Optimization, Maximize IOFSC

6.1 Click the button to maximize the Income Over Feed Supplement Cost (IOFSC) → [Maximize IOFSC]

			Current	Optimal
6.2	Expected Milk Producion (E-MP)	lb/cow/day	83.41	86.24
6.3	Maximum Income Over Feed Supplement Cost (IOFSC)	$/cow/day	5.54	5.99

[Print this Page]

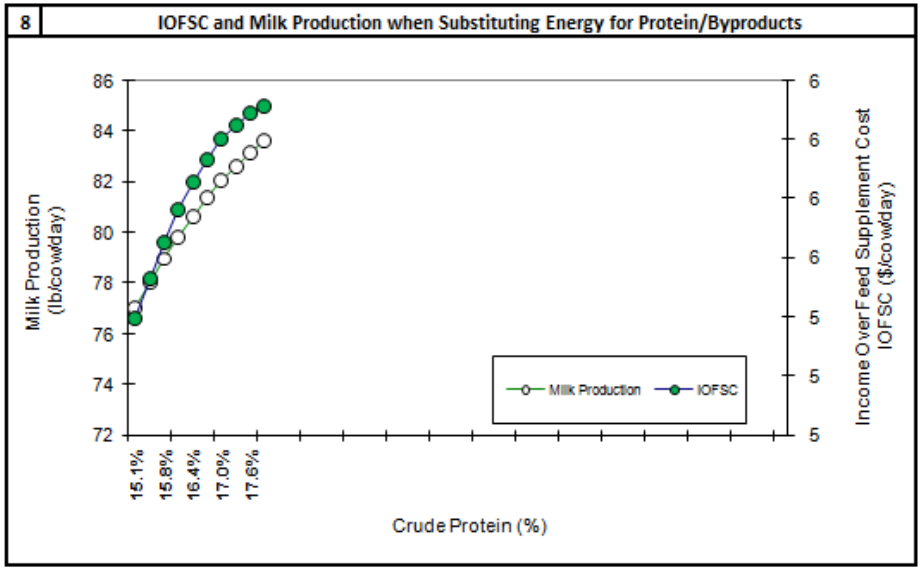
UW Extension — The University of Wisconsin Madison

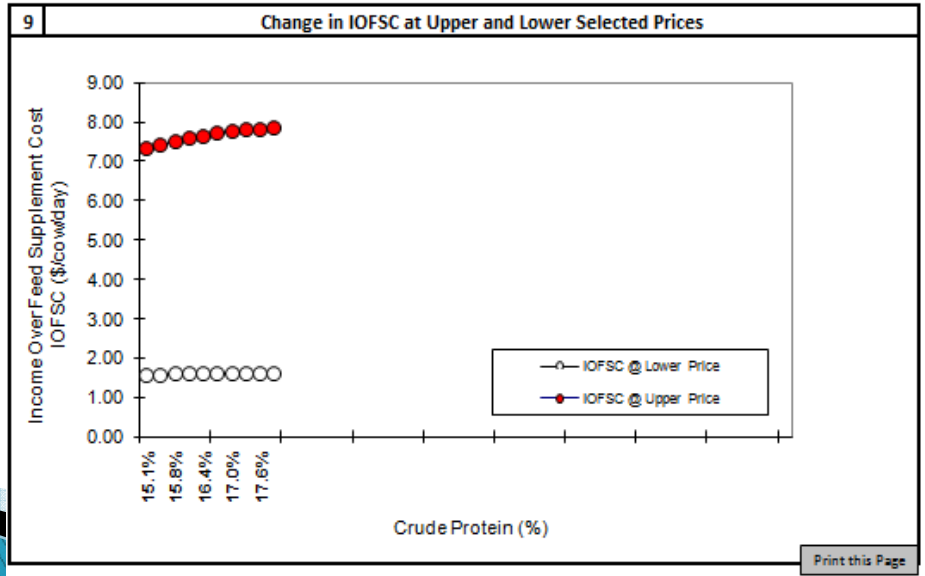
Online Application

Substitution of Supplements

INPUT		OUTPUT				
ENERGY	PROTEIN	RUP	RDP	CP	MILK	IOFSC
20.42	7.656	5.5%	9.7%	15.1%	77.43	4.75
….						
18.29	9.783	5.9%	10.0%	15.9%	80.43	4.78
….						
16.16	11.91	6.3%	10.4%	16.7%	83.22	4.79
….						
14.46	13.61	6.6%	10.7%	17.3%	85.3	4.78
….						
13.61	14.46	6.7%	10.8%	17.6%	86.29	4.76
….						
12.76	15.31	6.9%	11.0%	17.9%	87.25	4.75

Substitution of Energy/Protein





DairyMGT.info