

DELIVERY OF SUPPLEMENTS ON RANGELANDS

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Philosophy

- Forage is a large fixed cost
- Supplementation impacts cow performance
- Supplementation is also costly
- Goals:
 - Promote maximum utilization of forage
 - Improve livestock performance
 - Improve profitability

Topics

- Type of supplement
- Supplement delivery methods
 - Goals
 - Reduce cost
 - Uniform consumption
 - Other management needs

Four Supplementation Scenarios

1. Forage supply is unlimited and crude protein content of standing forage is greater than 7%.
 - Best scenario, no need for a supplement

Four Supplementation Scenarios (cont.)

2. Forage supply is abundant; however crude protein content is below 7%.
 - Most feasible scenario to use a supplement

Four Supplementation Scenarios (cont.)

3. Forage supply is limited, but it has greater than 7% crude protein.
4. Forage supply is limited and crude protein content is less than 7%.
 - Poor situations for supplementation

Four Supplementation Scenarios (cont.)

2. Forage supply is abundant; however crude protein content is below 7%.
 - Most feasible scenario to use a supplement

Type of supplement

- Supplements typically classified into:
 - Protein supplements
 - high in protein relative to other nutrients
 - examples: soybean meal, cottonseed meal
 - Energy supplements
 - low in protein relative to other nutrients
 - examples: corn, barley, sugar beet pulp
 - Both contain protein and energy

What type of supplement should be used?

- For low quality forages, protein is the first limiting nutrient
- Energy available in the forage (fiber) is of little use without protein to stimulate microbial digestion

Protein supplements with low quality forage

- Provides nitrogen for rumen microbe growth
- Promotes improved fiber digestion
- Rates of digestion and passage are increased
- Promote increased intake of low quality forage

Response to most energy supplements (e.g. grain)

- Depressed fiber digestion
 - microbial shift from fiber to starch digesting bacteria species
 - fiber digesting bacteria digest starch first
- Decreased forage intake
- No net increase in energy intake
 - Energy from grain substitutes for energy from forage

Effect of Protein Concentration on Forage Utilization by Cattle

| | % CP in supplement | | | |
|---------------------|--------------------|------|------|------|
| | 0 | 12 | 27 | 41 |
| Forage intake, % BW | .9 | .8 | 1.4 | 1.2 |
| Fiber digestion, % | 37.9 | 29.9 | 39.9 | 38.6 |

from DelCurto et al., 1990. J. Anim. Sci.

Effect of Protein Concentration on Cow-Calf Performance

| | % CP in supplement | | |
|-----------------|--------------------|------|-----|
| | 13 | 25 | 39 |
| Weight loss, lb | -193 | -122 | -97 |
| BCS loss | -1.8 | -1.4 | -.7 |
| Pregnancy rate, | 87 | 93 | 93 |

from DelCurto et al., 1990. J. Anim. Sci.

Fiber-based Energy Supplements

- High in readily-available fiber rather than starch or soluble sugars
- No depression in forage fiber digestion
- Does not stimulate or decrease forage intake
- Examples: many byproduct feeds
 - Sugar beet pulp
 - Soyhulls
 - Wheat midds

Supplement Delivery Alternatives

- Hand-fed
 - Readily and immediately consumed
 - Intake controlled by frequency
- Self-fed
 - Packaged to limit intake
 - Delivered in bulk
 - Eg.: liquids, block & tubs, intake limiters, e.g. salt

Hand-fed Delivery Frequency

- Depends on type
 - Protein vs. energy

Supplementation Frequency Cottonseed meal, 2 lb per d

| | Times delivered per week | | | |
|---------------------|--------------------------|-------|-------|-------|
| | 0 | 7 | 3 | 1 |
| Forage intake, kg/d | 10.3 | 9.0 | 8.6 | 8.8 |
| Weight loss, % | -19.1 | -11.0 | -14.1 | -13.1 |
| BCS loss | -1.5 | -.9 | -1.2 | -1.3 |

Huston et al. 1999

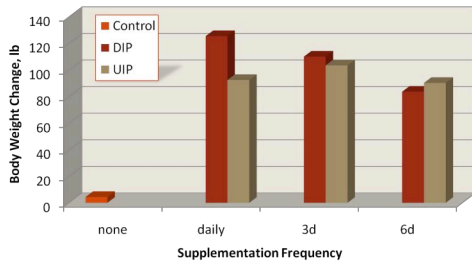
Supplementation Intake Variation

Cottonseed meal, 2 lb per d

| | Times delivered per week | | | |
|-----------------|--------------------------|-----|-----|-----|
| | 0 | 7 | 3 | 1 |
| Supp. intake SD | -- | .51 | .34 | .35 |

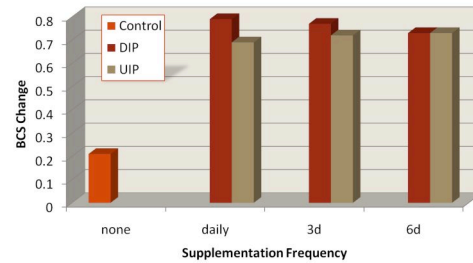
Huston et al. 1999

Influence of Protein Degradability



Bohnert et al., 2002

Influence of Protein Degradability



Bohnert et al., 2002

Grazing Behavior

| | Control | Daily | 6d |
|--------------------|---------|-------|------|
| Wt change, lb | 37.4 | 112.2 | 94.6 |
| BCS change | .01 | .45 | .32 |
| Grazing time, hr | 9.6 | 7.1 | 7.9 |
| Travel, mi | 3.7 | 3.6 | 3.7 |
| Max from water, mi | 1.2 | 1.2 | 1.1 |
| Distribution, % | 50.7 | 49.4 | 45.3 |

Schauer et al., 2005

Economics—Reduced Cost of Delivery

Assumptions:

1. Pickup depreciation: 15 miles @ \$0.50/mile
2. Labor: 1.25 hours @ \$10/hour

| Frequency | Cost |
|-----------------|----------|
| Daily | \$192.50 |
| Every third day | \$60.00 |
| Once per week | \$32.50 |

Infrequent Supplementation of Energy

| | Daily | Alternate day |
|-----------------|-------|---------------|
| Weight gain, lb | 142 | 69 |

- BCS increased by daily supplementation, only maintained on alternate day
- Rumen pH sometimes lower with alternate day supplementation

Adams, 1986

Self-fed Supplements

- Delivered infrequently in bulk
 - Reduces cost
 - Animals have continuous access for frequent consumption
- Packaged to limit intake
 - Block & tubs: hardness
 - Liquids: mechanism such as lick wheel
 - Intake limiters, e.g. salt

Self-fed Intake Variation

- Summary of 20 studies

| | Block | Liquid | Hand-fed |
|-------|-------|--------|----------|
| CV, % | 79 | 60 | 41 |

- Non-consumers

| | Block | Liquid |
|---|-------|--------|
| % | 5 | 19 |

Bowman & Sowell, 1997

Factors Contributing to Variation

- Block or tub hardness
- Crude protein content
- Forage quality
- Familiarity with the supplement
- Social interaction/dominance
 - Cow age

Cow Age

| | 2 | 3 | 4 | 5 | 6 |
|-------------------------|-----|------|-----|-----|-----|
| Intake, % _{RW} | .11 | .15 | .16 | .16 | .19 |
| CV, % | 82 | 89 | 63 | 98 | 52 |
| Non-users, % | 7.6 | 12.1 | 1.8 | 2.5 | 3.1 |

Sowell et al., 2003

Self-fed Supplements (cont.)

- Many self-fed supplements cost more than hand-fed alternatives
- Need to balance supplement cost with delivery cost

Delivery Cost Assumptions

- 300 cows
- 0.5 lb CP from 30% supplement
- \$250/ton for hand-fed
- \$550/ton for self-fed
- \$0.50/mile mileage for hand-fed
- \$1.00/mile mileage for self-fed
- \$10/hour for labor

Scenarios: Cost Delivered

| | Hand-daily | Hand-3x | Self- |
|----------|------------|----------|-----------|
| 10 miles | \$717.50 | \$617.50 | \$962.50 |
| 50 miles | \$1137.50 | \$947.50 | \$1162.50 |

Other Management Considerations

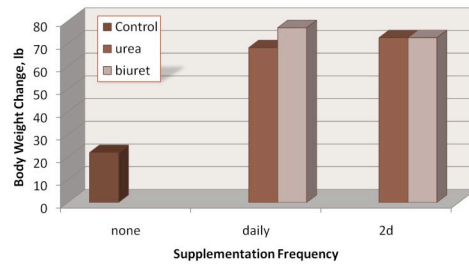
- Supplement placement to improve grazing distribution
 - Cooked molasses tubs (Bailey et al.)
 - Cows spent more time within 2000 ft of tub
 - Increased forage use near tub

Conclusions

- Infrequent delivery of hand-fed supplements
 - Typically reduces cost
 - Typically reduces variation of supplement intake
- Self-fed
 - Balance cost of supplement with delivery savings

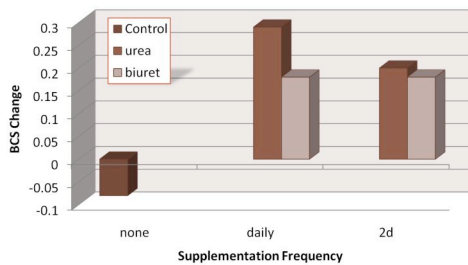


Non-Protein Nitrogen Supplemented Infrequently



Currier et al. 2004

Non-Protein Nitrogen Supplemented Infrequently



Currier et al. 2004

Infrequent Supplementation of Energy, cont.

| | Daily | Alternate day |
|----------------------|-------|---------------|
| Hay intake, lb | 20.3 | 20.1 |
| Hay Digestibility, % | 47.0 | 45.6 |
| Dig. DM intake, lb | 12.7 | 12.2 |

Chase and Hibberd, 1985

Supplementation Intake Variation

Cottonseed meal, 2 lb per d

| | Times delivered per week | | | |
|-------------------|--------------------------|------|------|------|
| | 0 | 7 | 3 | 1 |
| Weight loss | 4.11 | 5.61 | 5.38 | 4.29 |
| Supplement intake | -- | .51 | .34 | .35 |
| Forage intake | 1.63 | 2.88 | 1.73 | 1.62 |

Huston et al. 1999