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How Environmental Conditions Affect Cattle Diets

Kalynne R. Ewerks
Parkland College

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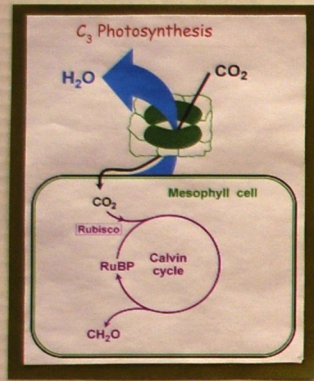
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How Environmental Conditions Affect Cattle Diets



C3 Plants



(Wang et al.)

What is a C3 plant?

- A plant that fixes Carbon in to a 3-Carbon compound
- Does not perform well under low CO₂ conditions
- Usually had slow and inefficient Carbon Dioxide fixation
- The cycle in a C3 plant happens in all plants (Major Differences)

How does a C3 plant work?

- CO₂ enters the plant
- Goes through the Calvin Cycle
- Makes the Rubisco enzyme or it leaves the plant as methanal (Major Differences)

Bibliography Page
Craine, Joseph M., et al. "Climate Change and Cattle Nutritional Stress." *Global Change Biology* 16.10 (2010): 2901-2911. Academic Search Complete. Web. 19 Sept. 2014.
Kimball, John W. "Photosynthesis and C4 Plants." *Kimball's Biology Pages*. The Saylor Foundation, 1994. Web. 1 Oct. 2014.
Major Differences. "Major Differences." *Difference between C3 and C4 Cycle (Calvin Cycle and Hatch and Slack Cycle)*. N.p., 2014. Web. 01 Oct. 2014.
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THE EXPERIMENT

How does temperature affect the quality?

- Warming during fall and spring-greater time of quality forages for C3 plants
- Increases in temperature favor C4 grasses-lower quality of grazing (Craine et al.)

How did scientists determine that the environment affects cattle nutrition?

- All of the data was collected between November 1 and April 1
- Had farmers all over U.S. take fresh fecal samples from 5-10 cattle and mail it (fresh or frozen) via two day delivery to the lab the scientists were working in
- Scientists then tested the composition of the fecal samples
- Looked for the concentrations of crude protein and digestible organic matter
- All of the cattle used in this study were also fed supplemental food (hay or grain)
- Did this work to determine if there was a major difference between C3 and C4 plants (Craine et al.)

Why should we care about climate change when it comes to our cattle?

- Beef is a food source
- If the climate becomes warmer and drier, cattle will be limited on their protein intake
- Might have to move towards breeds with low nutrient needs
- Farmers will have to change their ways of production to more supplemental feed which costs more
- If farmers costs go up they will have to reduce the number of cattle on their farms
- Reducing the number of cattle on farms ultimately reduces our food supply (Craine et al.)

How does precipitation affect the quality?

- Low precipitation, low Nitrogen in plant-usually better for C4 plants
- This means that if the plant does not have the adequate amount of nitrogen it will show signs of stress and will not grow to its full potential thus, decreasing the quality
- In native grasses, its different, plant nitrogen is lower with more precipitation
- C3 plants like more precipitation and a little more Nitrogen (Craine et al.)



(Craine et al.)

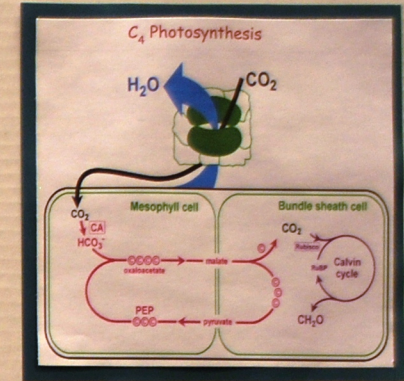
What did they find out about crude protein (CP)?

- Protein concentrations decreased when temperature increased
- Protein concentration were usually lower in warmer regions
- Decrease in precipitation, increased temperature, which ultimately decreased protein
- CP in warmer places would be sensitive to precipitation changes than CP in colder places (Craine et al.)

What did they find out about digestible organic matter (DOM)?

- The effect that climate had on CP was similar to the effect of DOM
- DOM increased and average precipitation increased
- Scientists decided that there was a difference between C3 and C4 plants but not enough to worry about it (Craine et al.)

C4 Plants



(Wang et al.)

What is a C4 plant?

- A plant that fixes Carbon in to a 4-Carbon compound
- Can perform under low CO₂ conditions
- Carbon Dioxide fixation is more efficient and faster
- The C4 Cycle ONLY happens in C4 plants (Kimball)

How does a C4 plant work?

- CO₂ enters the plant into the mesophyll cell
- It forms a C₃ compound (PEP)
- Which form a four Carbon compound (oxaloacetic acid) which turns in to malate
- At this stage it enters the bundle sheath cells and goes through the calvin cycle
- If it doesn't go through the calvin cycle it forms in to pyruvic acid (C₃) and is taken back to the mesophyll cells and turned back in to (PEP) and goes through the cycle again (Kimball)