Michael Cecava, Director of Feed Technology, ADM Research Division
Competing Uses for a Constrained Feedstock Supply: Risks and Opportunities
Biomass 2011 Roundtable, July 26, 2011

Lignocellulosic biomass as a starch replacement in livestock feed:

A paradigm shift in thinking

Lignocellulose to fuels: Animal feed can be an alternative

- Lignocellulose is a stable structural material and natural processes for conversion are slow
- The acme of biological lignocellulose conversion is the ruminant, employing mechanical grinding, multiple enzymatic systems and continuous chemical separations and endproduct removal
- The ruminant uses the fermentation products (short chain fatty acids) and microbial cell mass to maximize efficiency

Biomass to animal feed – another paradigm

Rather than sending corn to animal feed, can we replace corn starch with treated biomass to produce a balanced livestock ration?

If we can, less corn is fed to animals, more is available for processing and just as much meat is produced

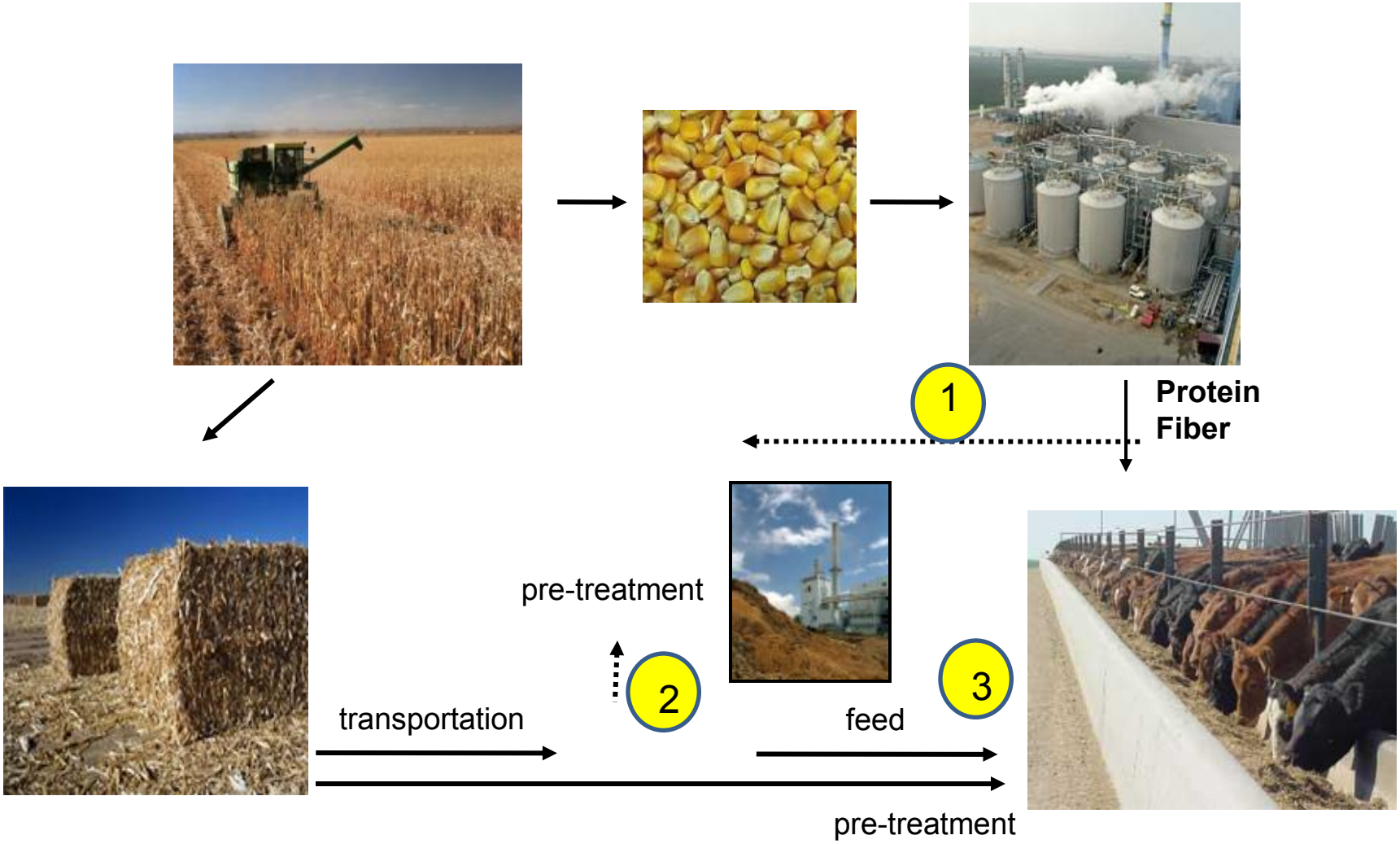
Treated Biomass + DDG

Starch and Biomass

By treating and feeding biomass to ruminants, we feed the animals a diet similar to their historical rations and likely reduce cost to the producer

Added benefit: Starch and biomass come from same land

Pre-treated lignocellulosics for livestock: Potentially more food and energy from existing cropland



Mild pre-treatment can improve feed value

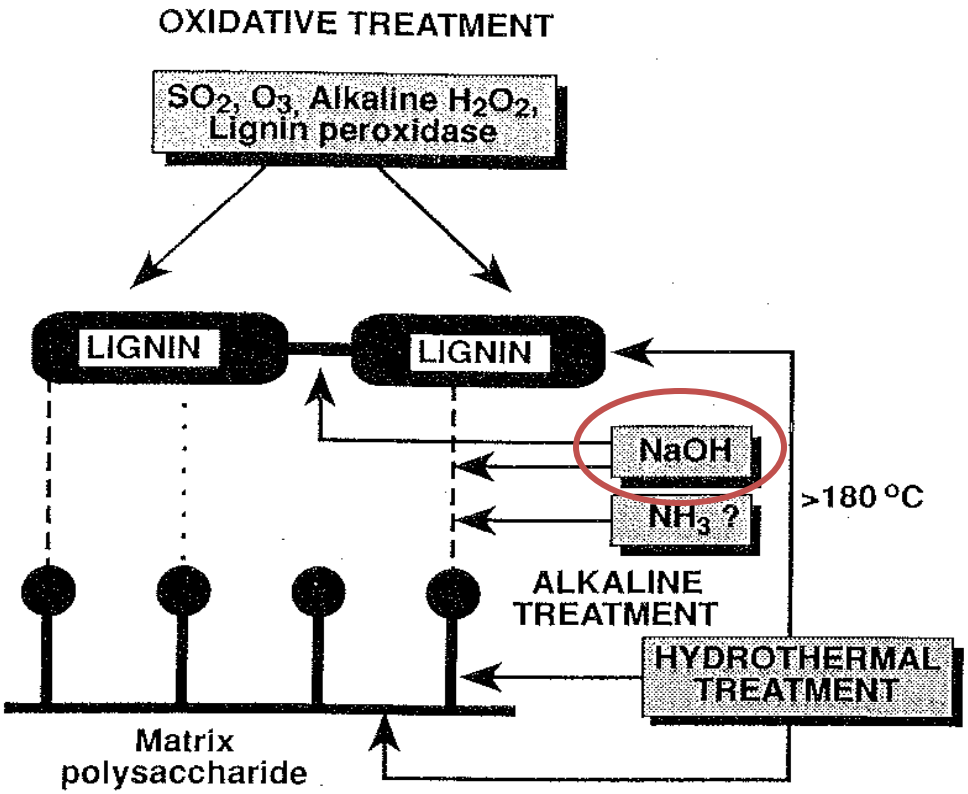
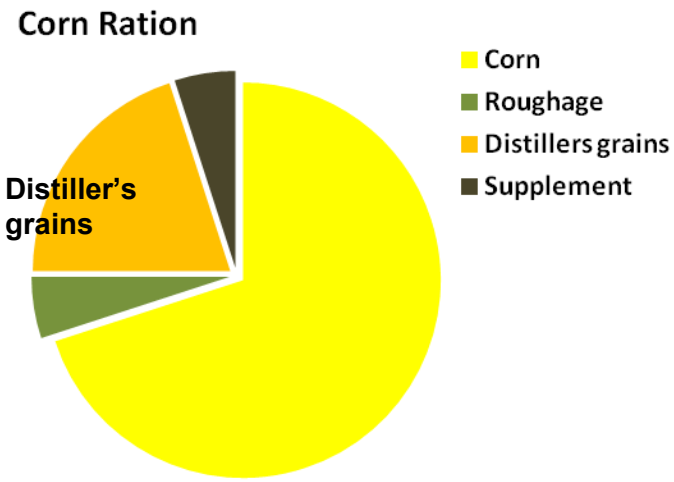
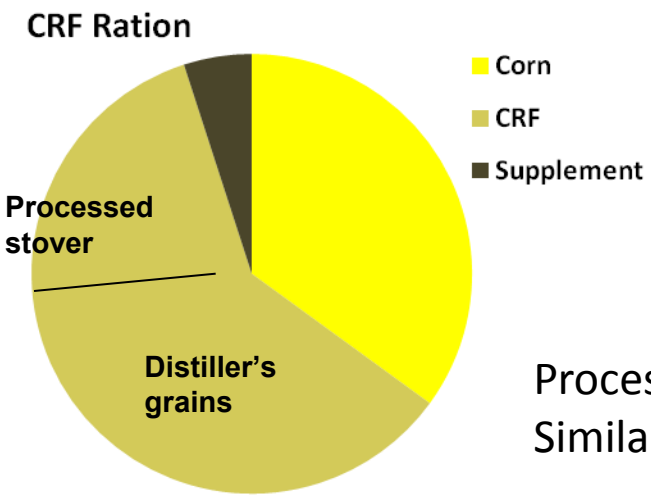
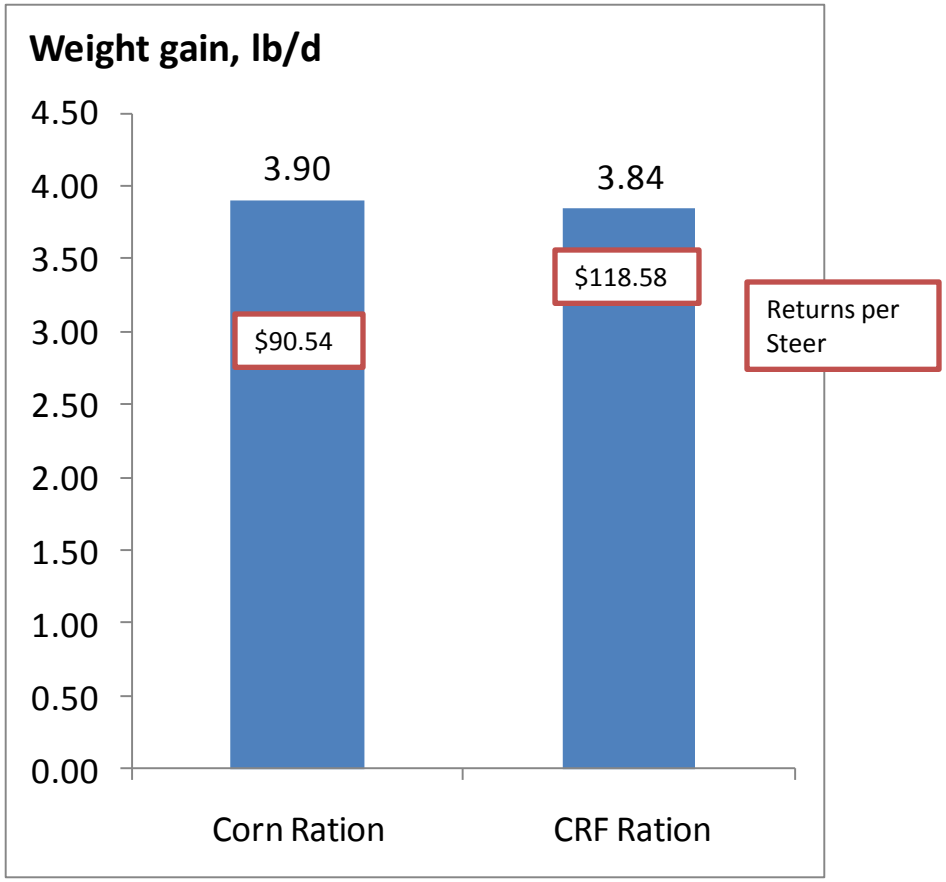


Fig. 14–3. A diagrammatic representation of the major effects of alkaline, oxidative, and hydrothermal treatments on a generalised lignin-carbohydrate complex. Solid lines represent glycosidic linkages, dashed lines represent alkali-labile (ester) linkages and dotted lines indicate ether bonding. (Adapted from Chesson, 1986.)

Pre-treated biomass and coproducts can economically displace corn in cattle rations







Processed stover and co-products displaced grain and roughage
Similar cattle performance and better returns per steer

ADM AFR 09-20 Cattle Feeding Trial Iowa State University

Using lignocellulosics as livestock feed: Grain replacement positives

- Residue collection window is wider because higher moisture is actually desirable
- Pre-treatment and ensiling creates stable biomass
- No significant additional water or energy usage
- Local use minimizes logistics and allows return of nitrogen, phosphate and potassium to cropland
- High energy efficiency 1:1 direct replacement for starch
- May significantly increase local farm income and re-diversify farms because logistical issues may demand it
- Develops local markets for wet coproducts making current ethanol plants more energy efficient

Addendum

Fate of corn produced in the US in 2010

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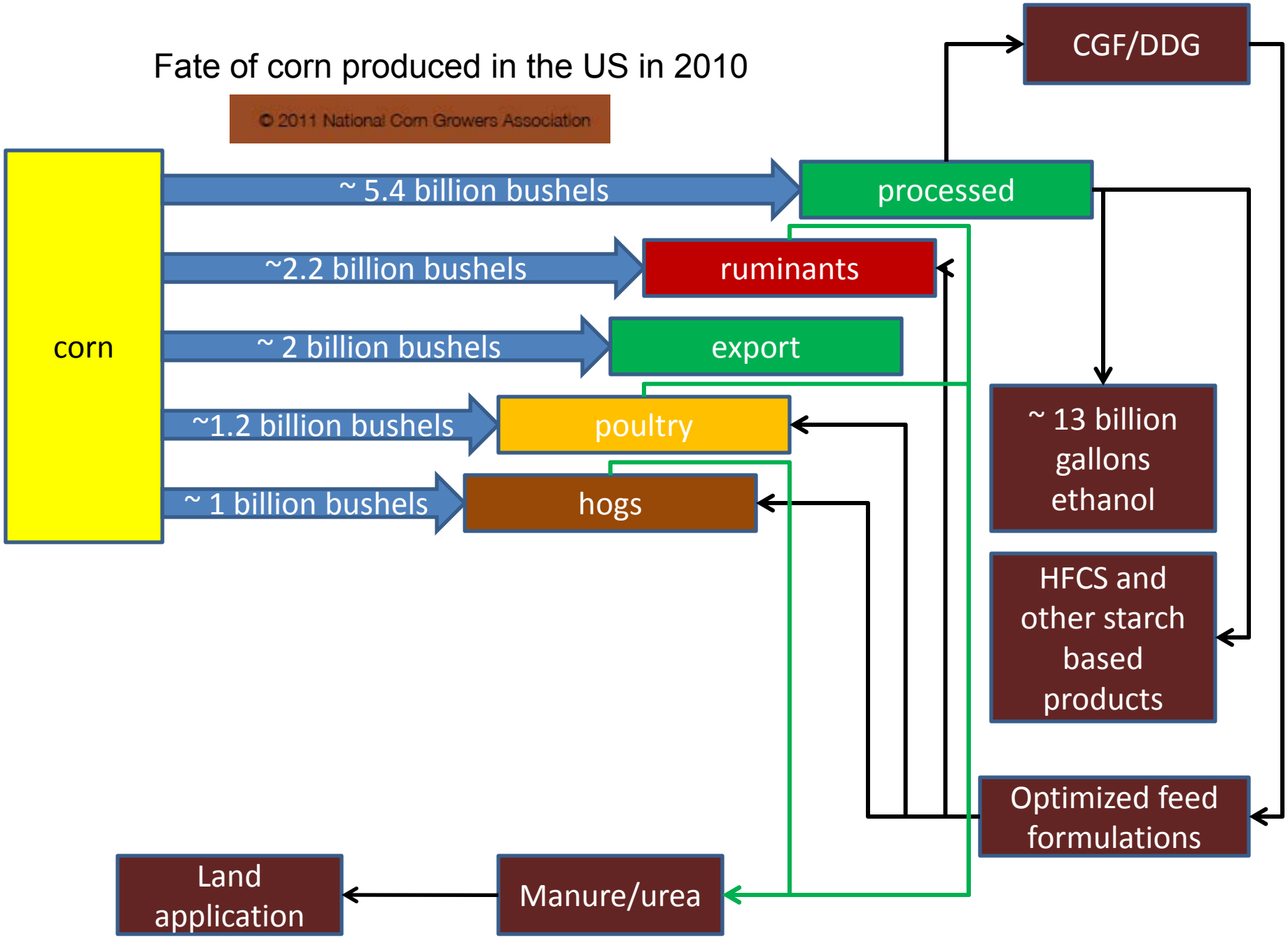

Cattle feeding trials demonstrate corn savings and economic feasibility of CRF rations

Ingredient % DM	Corn Rations	CRF Rations
Corn grain	45-50	35
Untreated residue	5-10	
Treated residue		20
Distillers grains	40	40
Supplement	5	5

University of Nebraska Beef Feedlot Trials					
	Dry feed intake, lb/d	Gain, lb/d	Gain:Feed	Additional profit/head	Corn saved, bushels
Trial 1 (140 day feeding)					
Control (33.7 bu @ $6/bu)	25.8	3.78	.146		
CRF (stover)	26.1	3.83	.146	+ $27	7.3
CRF (straw)	25.8	4.01	.155	+ $54	7.0
Trial 2 (150 day feeding)					
Control (37.5 bu @ $7/bu)	24.0	3.67	.153		
CRF (stover 3” grind)	23.5	3.58	.152	+ $39	11.5
CRF (stover 1” grind)	23.6	3.73	.158	+ $55	11.6