Grain Sorghum Residues and By-Products for Beef Cattle

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Crop Residue Grazing

Average Percentage Composition of Harvested Crop Residues – DM basis

		Crude Protein, %		IVDMD, %	
	% DM	Range	Average	Range	Average
Corn					
Grain	73	9.5-11.2	10.2	88-95	90
Leaf	76	6.2-7.5	7.0	41-65	58
Husk	55	3.0-4.0	3.5	63-72	68
Cob	58	2.1-3.8	2.8	59-65	60
Stalk	31	3.0-5.1	3.7	45-60	51
Milo					
Grain	74	10.3-11.0	10.5	85-95	90
Leaf	66	6.0-13.0	10.0	40-65	56
Stalk	25	3.3-3.9	3.6	53-58	57

Adapted from Grazing Crop Residues with Beef Cattle Extension Circular EC278

Similarities in Corn and Milo Residue

- Leaf and Stalk Residue is similar in digestibility
- Both will sustain mid to late-gestation cows without supplementation at least the first 50 days
- Cows grazing residue consume 20-50% of residue in 30-100 days
- Quality of the Diet Selected Decreases over time

Similarities Continued

- Corn and Milo will both yield about 16 lb dm in leaf and husk (or empty head) per bushel of grain
- Utilization is about 50%
- So 8 lb of dm is consumed

Pros of Grazing Grain Sorghum Residue

- Residue tends to off the ground more than corn
- Probably due to the harvest method
- Allows for grazing in deeper snow, less trampling of the “good stuff”
- Downed grain is a little safer

Brown Midrib Grain Sorghum Residue

				P -value
	Con	BMR	SEM	Hybrid
Initial Wt, lb	530	526	2	0.19
Ending Wt, lb	597	618	4	< 0.01
ADG, lb	1.03	1.39	0.06	<0.01

2 years of data, average 69 days grazing

6 steers/5.75 acre/ave. 69 days NE Beef Report 2010 pp.40-41

Brown Midrib Grain Sorghum Residue (Year 2)

	Leaves			Stems		
	CON	BMR	P-value	CON	BMR	P-value
NDF,%	73.2	73.8	0.56	76.3	77.2	0.37
IVNDF,%	48.8	58.7	<0.01	44.8	58.7	<0.01

2010 NE Beef Report pp. 35-36

Calculating Grazing Days

- 100 bu/acre grain (5600 lb grain/acre)
- 800 lb dm consumable for cattle per acre
- One 1200 lb cow = 936 lb dm feed for a month
- So this cow would need 1.1 acres for a month
- In that situation I could put 91 cows on 100 acres for one month

Issues with Grazing Residue

- Too much grain down in a field can create problems and must be managed carefully
- Small hard seed heads in milo make it less likely to cause founder, however, it can
- One milo head = .12 lb grain
- 466 milo heads= 1 bushel or 56 lb
- 10 bushel on the ground requires management

- Strip grazing has been more effective than cross fencing when grazing downed corn

- Possibly cross fencing would work better with milo due to the decreased availability of the grain

Sustainable Residue Harvest:

Approximately 1 ton of crop residue (at 10 percent moisture) is produced with:

40 bushels of corn or grain sorghum
40 bushels of soybean
15 bushels of wheat

To maintain soil organic matter the best current estimate is that 2 to 3 ton/acre of crop residue should be left in the field annually

Source: Harvesting Crop Residues (Wortmann et al., 2012) UNL NebGuide G1846

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Issues with Grazing Residue

- In our previous example we had 100 bu/acre crop leaving 1600 lb of “good stuff” for cattle
- 800 lb/acre would really be consumed, not tromped on etc.

- If 100 bu/ac produces 5000 lb of residue
- 5000-800 = 4200 lb
- The digestibility of the diet is about 45%
- So 55% of that organic matter is put back
- 4200 lb + 440 lb = 4640 lb
- The recommendation was to leave 2-3 ton
- Removal of residue by cattle grazing is less than 15% in most cases

- If removal exceeds recommendations due to drought or other circumstances more than one year consider adding manure

- Always use common sense for the benefit of the animal and the crop ground

Years of Study[1]	Cropping System[2]	Crop	Grazed Yield	Ungrazed Yield	SEM	P value
93-95	Irrigated Corn-Soybean[3] Rotation	Soybeans	54.6667	55	3.3747	0.7418
93-95	Dryland Strip Cropping[4]	Soybeans	39.3333	42.6667	17.5431	0.8289
93-95	Dryland Strip Cropping[4]	Grain Sorghum	106.33	107	17.5431	0.8289
93-95	Dryland Strip Cropping[4]	Corn	184.67	174.67	17.5431	0.8289
93-95	Irrigated Continuous Corn[5]	Corn	185.33	181.67	27.3272	0.5766
96-11	Fall Grazed Corn-Soybean[6]	Soybeans	62.4	60.4	2.1056	0.001
96-11	Fall Grazed Corn-Soybean[6]	Corn	208.9	205.8	7.8359	0.1808
96-11	Spring Grazed Corn-Soybean[6]	Soybeans	61.7	60.4	2.0156	0.001
96-11	Spring Grazed Corn-Soybean[6]	Corn	207.2	205.8	7.8359	0.1808

[1] Starting and ending year that the study was conducted

[2] Type of cropping system that the field was managed in.

[3] Center pivot irrigation, corn residue grazed and soybean yields reflect impact of grazing on yields.

[4] This field was in a strip cropping study in a rotation where residue from all crops was grazed. Corn followed soybeans, grain sorghum followed corn, and soybeans followed grain sorghum.

[5] Was maintained in a continuous corn system.

[6] Fields are from linear move irrigation field and maintained in corn followed by soybean rotation for 14 years.

- Crop Residues will continue to be an important resource for Nebraska's cattle industry

- Reasonable use of crop residues can be beneficial to both cattle and crop producers

Sorghum Distillers Grains

- Research comparing Sorghum and Corn Distillers Grains is somewhat limited
- Very difficult to find ethanol plants willing to produce both without blending
- Distillers can be variable from plant to plant (Buckner et al. 2011)
- Results of corn or sorghum DGS can vary depending on location

Southern vs. North Plains

- Steam flaked corn vs. dry rolled corn
- Fat additions to the diet
- Differences in Solubles markets

- Different doesn’t equate to wrong
- But differences need to be recognized

Sorghum Distillers

- Al-Suwaiegh et al. (2002) (Rick Grant and Terry Klopfenstein) – corn and sorghum distillers from the same plant

- Finishing yearlings were fed DRC based diets with 30% corn or sorghum DG

Table 4. Effects of corn and sorghum distillers grains on performance and calculated dietary NE_g values in dry-rolled corn-based diets fed to finishing yearling steers

		Distillers grain type			Probabilities[a]	
Item	Control	Corn	Sorghum	SE	Control vs distillers	Corn vs sorghum
Number of steers	19	20	19			
Performance						
Initial weight, kg	359	358	359	5		
Final weight, kg[b]	570	587	598	8	0.03	0.37
DMI, kg/d	10.7	10.4	11.1	0.2	0.71	0.02
Daily gain, kg	1.65	1.80	1.87	0.04	<0.01	0.19
Gain/feed, kg/kg	0.156	0.173	0.168	0.110	<0.01	0.25
Calculated NE_g values, Mcal/kg						
Diet	1.28	1.43	1.39	0.02	<0.01	0.15
Wet distillers grains	—	2.00	1.87			

[a]Control vs distillers = Control vs the average of wet corn and sorghum distillers grains; Corn vs sorghum = corn vs sorghum distillers grains.

[b]Determined as hot carcass weight/0.63.

- Corn DG 33.3% more TDN than DRC
- Sorghum DG 24.7% more TDN than DRC
- Translation:
- DRC 90% TDN
- CDG 120% TDN
- SDG 112% TDN

- In the same study lactating dairy cow performance was unaffected by the addition of DG
- Tendency (P = 0.15) for 6% decrease in 4% corrected milk production

- Lodge et al. (1997)
- 80% sorghum 20% corn blend
- Compared wet vs. dry
- With and without solubles added
- 40% distillers replaced DRC on dm basis

Table 4. Effect of sorghum wet and dry distillers byproducts on finishing yearling performance and net energy for gain

Item	Control	SWDG[a]	SWDGS[a]	SDDGS[a]	SEM
DM intake, kg/d	12.11	11.97	12.23	12.49	.38
Daily gain, kg	1.86	1.83	1.91	1.78	.10
Gain/feed	.153[b]	.153[b]	.155[b]	.142[c]	.003
NE_g, Mcal/kg[d]	1.29[b]	1.29[b]	1.32[b]	1.20[c]	.02
Fat thickness, cm	1.1	1.1	1.1	1.1	.03
Quality grade[f]	18.8	19.0	19.0	19.3	.3

[a]SWDG = wet distillers grains; SWDGS = wet distillers grains plus solubles; SDDGS = dried distillers grains plus solubles.

[b,c]Means within a row with unlike superscripts differ ($P < .05$).

[d]Based on cattle performance (Larson et al., 1993).

[f]High Select = 18; Low Choice = 19.

- Lodge et al (1997) calculated feeding values

	Relative Neg	%TDN
DRC		90
SWDG	96	86.4
SWDGS	102	91.8
SDDGS	80	72

- In a metabolism trial corn and sorghum distillers (wet and dry) were fed to lambs (80% of diet dm)

- Organic matter and Nitrogen digestibility were higher for wet corn distillers than sorghum

- Depenbusch et al. (2009) used sorghum DG from KS and corn DG from NE

- They found no differences in performance or carcass characteristics when corn or sorghum DG replace 15% DM in a SFC based finishing diet

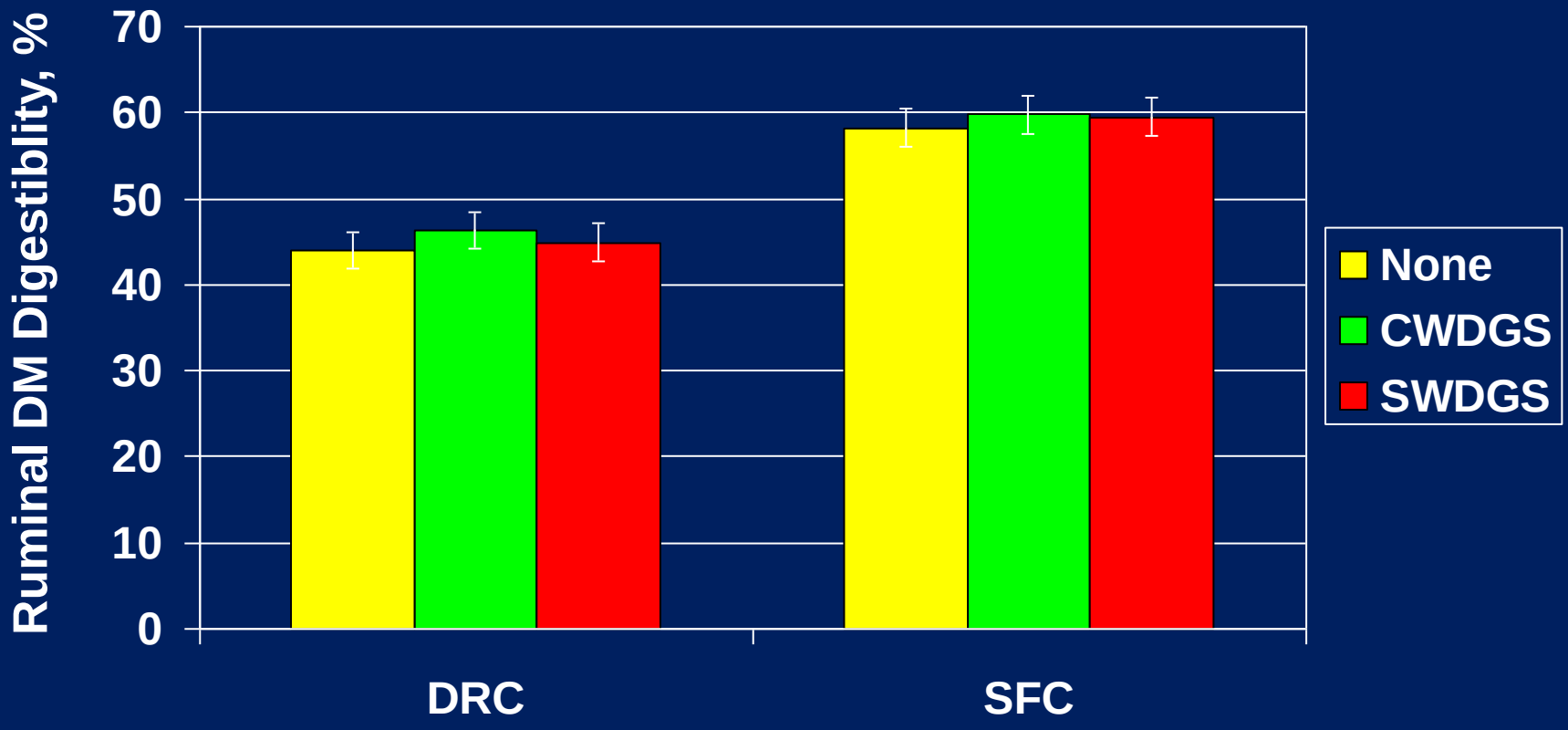
- May et al. (2010) replaced 15 or 30% DM in SFC based diets with sorghum or corn distillers or a 50% blend of the two
- Sorghum DG increased DMI
- Adding distillers did not improve performance

- Study by Lewis et al (2008) evaluated in situ digestibility of corn and sorghum distillers grains

WDGS Nutrient Composition

Item	Corn WDGS	Sorghum WDGS
DM, %	34.1	33.9
CP, %	26.8	39.2
Fat, %	11.0	8.7
NDF, %	23.0	43.9

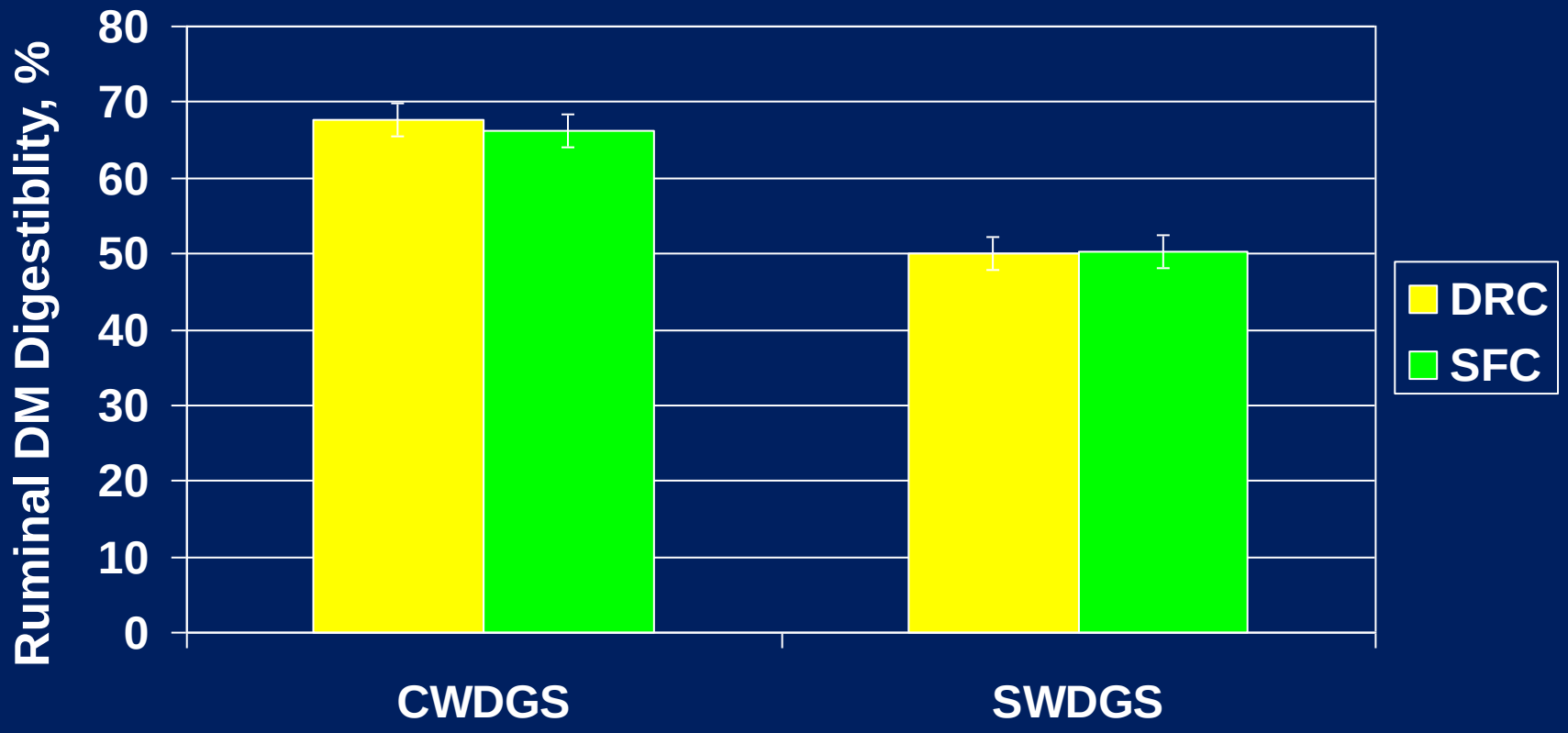
Effect of WDGS on the Digestibility of Corn



DRC vs. SFC ($P < 0.01$)
WDGS ($P = 0.45$)

Interaction ($P = 0.93$)
Assumes kp = 0.05/hr

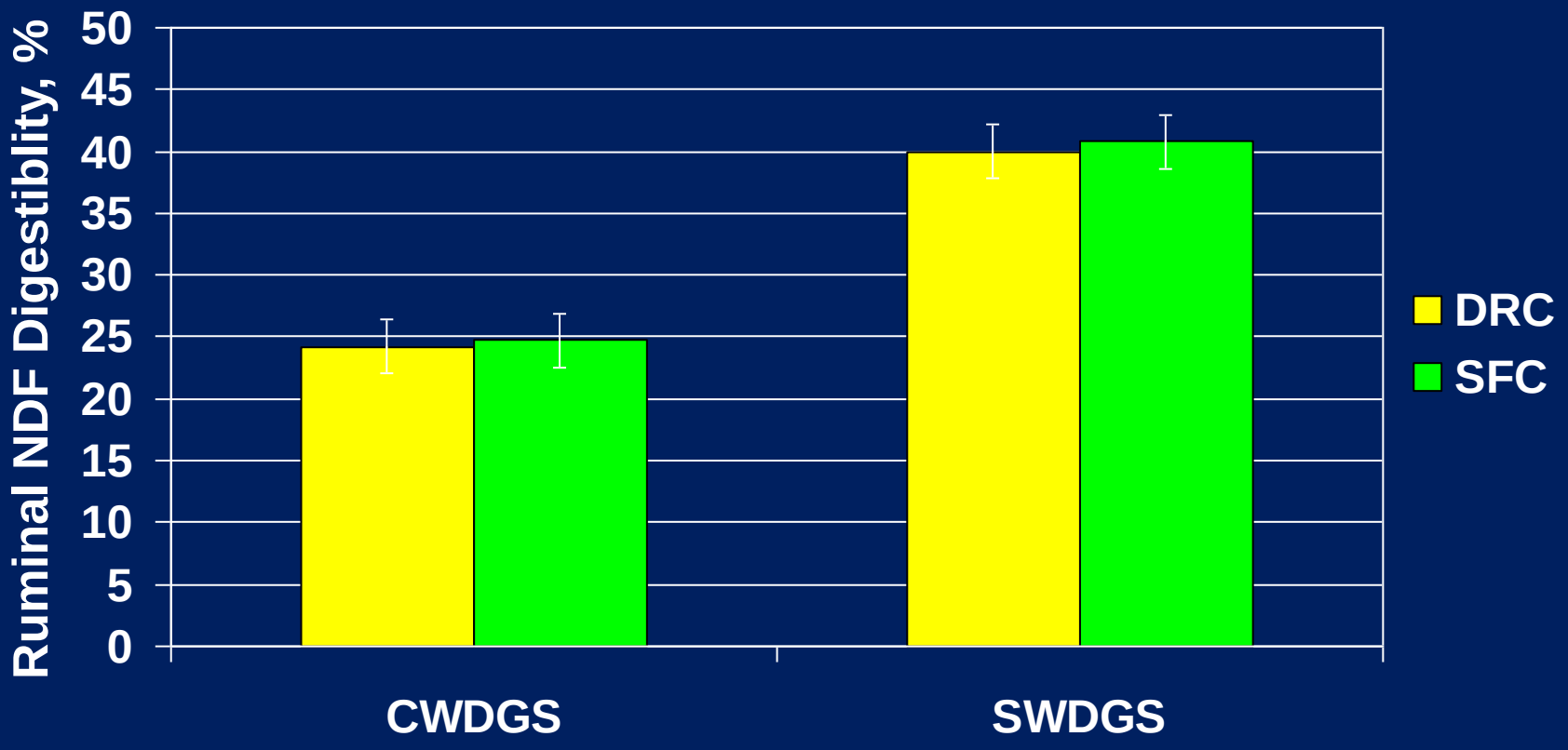
Effect of Corn Processing on the Digestibility of WDGS



DRC vs. SFC (P = 0.73)
CWDGS vs. SWDGS (P < 0.01)

Interaction (P = 0.60)
Assumes kp = 0.05/hr

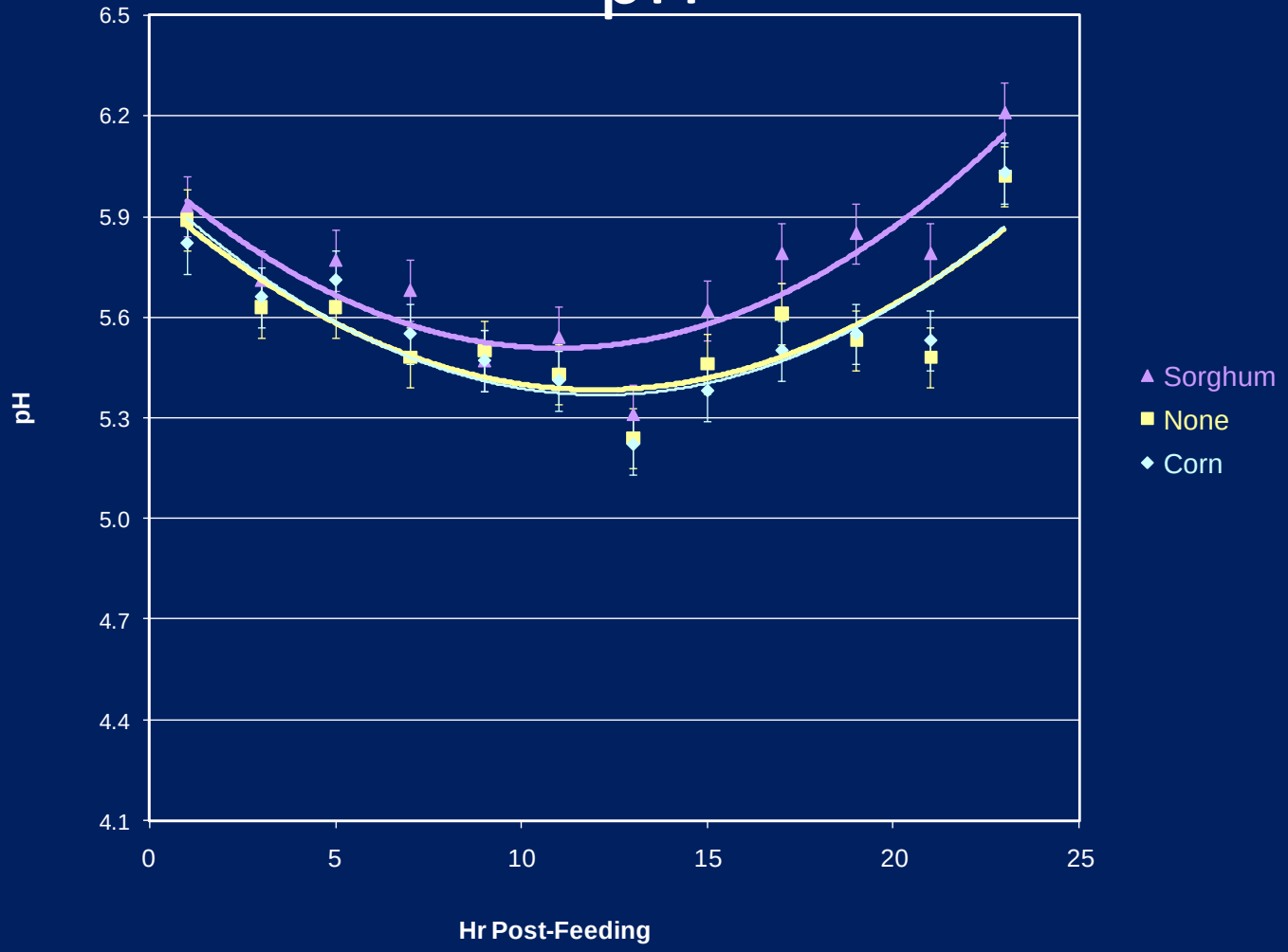
Effect of Corn Processing on the Digestibility of WDGS



DRC vs. SFC ($P = 0.69$)
CWDGS vs. SWDGS ($P < 0.01$)

Interaction ($P = 0.95$)
Assumes kp = 0.05/hr

Distiller's Grains Source and Ruminal pH



Corn WDGS vs Control (P = 0.68)
Sorghum WDGS vs. Control (P = 0.04)

- Organic Matter Digestibility in Corn WDGS was greater than sorghum WDGS

- NDF digestibility was greater in Sorghum WDGS

- Research on Sorghum WDGS as a supplement for cattle grazing low quality forages is extremely limited

- Sorghum WDGS may fit this sector due to its digestible NDF content and lower lipid content

- Sorghum WDGS has been shown to be similar in energy to DRC

- Questions?