



Dairy Technical Bulletin

QLF Research Summary Effect of Urea Addition to Corn Silage on Composition & Dry Matter Loss

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Background: QLF Silage 100 provides an economical, efficient, and palatable method to raise crude protein content of corn silage. Crude Protein provided by QLF Silage 100 is in the form of urea (NPN). Does urea addition to chopped corn at the time of ensiling have any effect on fermentation profile, DM loss, or nutrient digestibility? The following tables contain data from research studies that help answer these questions.

In this study below, dry urea was added to corn silage of 3 maturities. Silages were fed to lactating cows; milk yield was unaffected by urea addition to corn silage. However, persistency of milk production tended to be higher for the cows fed urea-treated low- and medium DM silage compared to cows fed urea treated high DM corn silage.

Item	Low-DM Silage		Med. DM Silage		High DM Silage	
	Control	0.5% Urea	Control	0.5% Urea	Control	0.5% Urea
Corn Silage Analyses						
Dry Matter %	30.1	30.6	36.1	36.5	43.7	44.8
Organic Acids (g/100 g DM)						
Lactic	8.72	10.23	7.83	8.44	5.68	6.99
Acetic	2.18	2.04	1.39	0.92	0.96	0.84
Propionic	0.04	0.08	0.07	0.10	0.17	0.13
Butyric	0.36	0.15	0.05	0.04	0.12	0.03
Silage pH	3.89	3.91	3.97	3.95	3.87	4.01
ADF (g/100 g DM)	26.1	25.7	24.8	21.1	28.5	27.4
Crude Protein, % of DM	9.5	14.6	9.4	13.7	9.3	12.5
Dry Matter Loss, % of that ensiled	6.4	7.7	2.1	10.7	10.1	20.1
Crude Protein Loss, % of that ensiled	10.2	11.2	2.1	6.1	1.9	19.1
Huber et al. 1968. JDS 51:1806-1810						

Take Home Message: In this study, adding 0.5% urea to corn silage had minimal effect on silage fermentation or pH. Lactic acid concentration was numerically higher with urea addition. As expected, silage crude protein was higher with urea addition. Urea addition increased dry matter loss at all 3 silage maturities. Perhaps the increased dry matter loss with urea addition was due to gas losses during fermentation.

In the next study, lactating cows were fed corn silage free choice, with balanced supplements to provide isonitrogenous rations. Milk yield was unaffected by urea addition to corn silage.



Nutrition and More . . .

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Item	Control	0.6% Urea	0.8% Urea
Study 2 - Polan et al. 1968. JDS 51:1445-1449			
Dry Matter%	43.5	36.6	31.7
Silage pH	Not reported	4.3	4.0
Crude Protein, % DM	9.9	12.7	16.6
Nutrient Digestibility			
DM	62.8	62.6	61.5
CP	57.0 ^c	59.9 ^c	50.6 ^d
Crude Fiber	48.6	42.4	50.6
NFE	68.2	68.6	66.2
Ether Extract	67.3 ^c	70.1 ^a	75.4 ^{bd}

Take Home Message: In this study, adding 0.6% or 0.85% urea did not affect DM digestibility. CP digestibility was reduced at 0.85% urea inclusion, but Ether extract digestibility was increased by both 0.6% and 0.85% urea inclusion.

The first 2 studies used urea at 0.5 – 0.83% to increase corn silage crude protein content from ~9% to ~13%. Adding 41 lbs of QLF Silage 100 per ton of 35% corn silage will raise crude protein from ~8% to ~13%. Using 41 lbs of QLF Silage 100 provides approximately 0.7% urea inclusion per ton of corn silage, similar urea inclusion rates in the above studies.

The above 2 studies show that urea addition does not have a negative effect on corn silage fermentation, pH, or nutrient digestibility. The crude protein in Silage 100 is from urea, but Silage 100 differs from dry urea in the following ways.

- Silage 100 is a liquid supplement. It is 52% dry matter, which allows for ease of application and distribution onto moist silage. Applying a liquid urea source onto a moist corn silage is a safe way to deliver supplemental urea – it disperses the desired urea into a large, palatable “package”, for instance 40 lbs of corn silage.
- Silage 100 contains added acids, and has a pH of ~3.0.
- Silage 100 contains a low level of sugars from cane molasses and condensed whey, to help feed bacterial fermentation.
- Silage 100 has a nitrogen:sulfur ration of 12:1, to aid NPN utilization

Silage 100 is designed to economically increase crude protein content of corn silage. However, it is NOT a replacement for inoculant. Good quality inoculants enhance populations of beneficial bacteria to improve fermentation and feeding quality of treated silages.

A research report from Kansas State University (1990) provides fermentation data for corn silage treated with an inoculant, LSA-100 (100% Crude Protein Liquid Silage supplement, similar to QLF Silage 100), and LSA-100 + inoculant. The data shown is a mean value of 3 PVC silos. Researchers evaluated pH and lactic acid concentration up to 7 days, and fermentation analyses at 90 days.

		Control	Liquid-Teem (inoculant)	LSA-100 (similar to Silage 100)	Liquid-Teem + LSA-100
Time Post Filling					
6 hr	pH	4.95	4.92	5.14*	5.21*
12 hr	pH	4.44	4.40*	4.57*	4.56*
	Lactic Acid	1.66	1.78*	1.45*	1.48*
24 hr	Ph	3.90	3.85*	3.95	3.90
	Lactic Acid	3.58	4.04*	3.75	3.90
48 hr	pH	3.70	3.68	3.71	3.68
	Lactic Acid	4.70	5.15*	4.78	4.95
7 day	pH	3.71	3.69	3.71	3.71
	Lactic Acid	4.96	5.28*	5.15	5.36*
90 day	pH	3.66	3.64	3.67	3.68
% DM	Lactic Acid	5.04	5.36	5.16	5.48
% DM	Acetic Acid	2.75	1.96*	2.56	2.06*
% DM	Ethanol	0.68	0.46*	0.76	0.58
% DM	NH3-N	.106	.088	.448*	.426*
% DM	CP %	9.06	9.01	12.85*	12.95*

Take Home Message: Whole plant corn silage ensiled rapidly, with the control reaching pH < 4.0 within 24 hours. Adding a liquid urea-based silage additive did not have a negative effect on fermentation. By 7 days of fermentation, lactic acid concentration is highest in the silage treated with inoculant or LSA-100 + inoculant. This data demonstrates that adding liquid urea-containing silage products to corn silage increases silage crude protein content, and that inoculants stimulate increased lactic acid production.

In conclusion, liquid urea-based silage additives such as QLF Silage 100 can be an economical, efficient way to deliver supplemental urea and increase crude protein of corn silage. Good quality silage inoculants help optimize bacterial population, fermentation, and feeding quality of corn silage.

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*Statistical analyses showed control versus treatment means differed ($P < 0.05$)