

Forage and Feed Volatile Fatty Acid (VFA) and Fermentation Compound Guidelines

Summarized by Dr. John Goeser, PAS & Dipl. ACAN
Revised January, 2016

Corn Silage Compounds	Published Means ¹	Typical ²	RRL Means	Guideline	% RRL Met Guideline
pH	3.72	3.7 to 4.2	4.10	< 4.0	50.0%
Lactic	5.41	4 to 7	4.47	> 3.50	68.0%
Acetic	2.29	1 to 3	2.26	< 2.00	50.0%
Propionic	0.12	< 0.1	0.24	< 0.25	72.0%
Butyric	0.00	0.00	0.06	0	NA
EtOH	1.40	1 to 3	0.58	< 0.50	57.0%
Total Acids	7.83	NA	7.03	NA	NA
Lac:Acet	2.557	NA	1.98:1	> 3:1	61.5%
NH ₃ -N, % CP	NA	5 to 7	9.50	NA	NA

Legumes Compounds	Published Means ¹	Typical ²	RRL Means	Guideline	% RRL Met Guideline
pH	4.63	4.3 to 4.7	4.93	< 4.5	35.0 %
Lactic	6.84	2 to 10	4.12	> 3.0	70.0 %
Acetic	2.01	0.5 to 3	1.79	< 1.5	52.0 %
Propionic	0.04	< 0.5	0.15	< 0.25	80.0 %
Butyric	0.07	< 0.5	0.38	< 0.25	65.0 %
EtOH	3.26	0.2 to 1	0.32	NA	NA
Total Acids	8.96	NA	6.44	NA	NA
Lac:Acet	3.55	NA	2.30:1	> 3:1	60.0 %
NH ₃ -N, % CP	10.00	8 to 15	10.0	< 10	55.0 %

Grasses/Small Grains Compounds	Published Means ¹	Typical ²	RRL Means	Guideline	% RRL Met Guideline
pH	4.19	4.3 to 4.7	4.18	< 4.0	40.0 %
Lactic	4.41	2 to 10	5.12	> 3.0	72.0 %
Acetic	2.73	0.5 to 3	2.16	< 1.5	47.0 %
Propionic	0.40	< 0.5	0.18	< 0.25	75.0 %
Butyric	0.01	< 0.5	0.47	< 0.25	67.0 %
EtOH	1.49	0.2 to 1	0.77	< 0.50	47.0 %
Total Acids	7.55	NA	7.93	NA	NA
Lac:Acet	1.79	NA	2.37:1	> 3:1	58.5 %
NH ₃ -N, % CP	13.9	8 to 15	13:3	< 10	50.0 %

High Moisture Corn Grain Compounds	Published Means ¹	Typical ²	RRL Means	Guideline	% RRL Met Guideline
pH	4.22	4 to 4.5	4.45	< 4.5	60.0 %
Lactic	1.07	0.5 to 2	1.54	> 1.75	40.0 %
Acetic	0.51	< 0.5	0.46	< 0.5	61.0 %
Propionic	0.05	< 0.1	0.10	NA	NA
Butyric	0.00	0	0.35	NA	NA
EtOH	0.84	0.2 to 2	0.30	< 0.25	57.0 %
Total Acids	1.63	NA	2.45	> 2.5	35.0 %
Lac:Acet	2.60	NA	3.35:1	> 3:1	NA
NH ₃ -N, % CP	NA	NA	4.90	NA	NA

Note:
ND = none detected, NA = not available

¹Research means were weighted by treatment number within a study and summarized from published cited below. The numbers of experimental treatments summarized from cited references below were as follows: Corn Silage n = 159, Legumes n = 36, Grasses and Small Grains n = 59 and High Moisture Corn Grains n = 32.

²Typical values adapted from those published by Kung and Shaver (2001).

³Guidelines developed from Research Averages, Typical values, Rock River Laboratory means, and from published references cited below.

References

- Adesogan, A., 2008. FL Ruminant Nutr. Symp.
- Arriola et al., 2012. JDS 95:964-974.
- Bai et al., 2011. African J. of Biotech. 10:9958-9968.
- Branislav et al., 2008. J Central European Agric. 9:439444.
- Filya et al., 2007. JDS 90:5108-5114
- Kleinschmit and Kung, 2006. JDS 89:4005-4013.
- Kung, L. and R. Shaver, 2001. Focus on Forage Vol. 3 (No. 13) 1-5.
- Kung et al., 1993. JDS 76:3763-3770
- Kung et al., 2004. J Dairy Sci. 87:1310-1316.
- Kung et al., 2007. J Dairy Sci. 90:2309-2314.
- Muck, R.E. 1988. JDS 71:2992-3002.
- Reigh and Kung, 2010. AFST 159:105-109
- Schaefer et al., 1989. Anim Feed Sci Tech 25:23-28.
- Taylor and Kung, 2002. JDS 85:1526-1532.
- Teller et al., 2012. JDS 95:1428-1436.
- Tabacco et al., 2011. JDS 94:5589-5598
- Weinberg et al., 2007. JDS 90:4754-4762
- Young et al., 2012. JDS 95:6687-6694.
- Zhang et al., 2009. World J Microbiol Biotechnol. 25:965-971.