

# Total Mixed Ration Mineral Content in California Dairy Farms



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## INTRODUCTION

Water Quality Regulations based on Waste Discharge Requirements (WDR) are affecting all dairy producers in California.

The WDR consist of:

- (1) Waste Management Plan (WMP)
- (2) Nutrient Management Plan (NMP), with nitrogen as the main concern.

There are ten minerals with potential effects on crop yield or the environment (Cd, Cu, Fe, Hg, P, K, Na, Se, S, and Zn), where P is the main concern. NRC (2005).

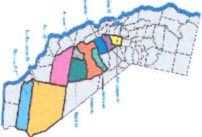
The bioavailability of minerals of common feeds is not well characterized and affected by intake level, feed type, variations of the same feed, interactions between minerals, soil fertilization, method of analysis, etc. (NRC 2001, 2005)

This study was designed to identify mineral composition in lactating dairy cows diets in commercial dairies.

## METHODS

Dairies Surveyed

- Number of dairies: 40
- Location: Merced County, CA
- Herd size: 787 cows (210 to 2435)
- Mean Milk production 3.54FC:
- 31.8 kg (20.6 to 43.5 kg)
- Mean TS in drinking water: 550 mg/L (100 to 1700 mg/L)



Sample Size

- Total Mixed Rations (TMR): from 40 dairies (total 138 TMR or groups of cows)
- All dairies taken from a water trough
- All samples were collected in duplicate on two non-consecutive days

Sample Analysis

Wet chemistry (UC Davis, ANR Lab) for calcium, phosphorus, magnesium, chloride, potassium, sodium, sulfur, copper, iron, manganese, selenium, and zinc.

Dietary Mineral Content Calculation

- (1) TMR mineral intake content weight by the proportion of animals in each production group.
- (2) Drinking water mineral content. Total intake of minerals from water was estimated based on Murphy et al. (1983) and flow meters.

Milk Production

Estimate based on Dairy Herd Improvement (DHI) records and when not available, on bulk tank milk data.

TMR mineral Content were Classified as:

- 1) < 80%
- 2) 80 ≥ to 120%
- 3) 120 ≥ to 200% and
- 4) ≥ 200%

The higher near value for milk production was used to determine NRC mineral requirements.

Dietary Mineral (TMR+water) were compared to Maximum Tolerable Levels (MTL) according to the NRC (2005)

## RESULTS

Table 1. Proportions of dairies (n=40) fed different percentages of NRC requirements in the TMR.

Minerals	< 80	80 ≥ to 120	120 ≥ to 200	≥ 200
Ca <sup>1</sup>	2.5	40.0	57.5	—
P	—	37.5	62.5	—
Mg	—	—	82.5	17.5
K	—	2.5	32.5	65.0
Cl	—	7.5	85.0	7.5
Na	—	15.0	37.5	47.5
Se	—	25.0	75.0	—
Cu	7.5	27.5	47.5	17.5
Fe	—	—	—	100.0
Mn	—	15.0	—	100.0
S	2.5	—	77.5	—
Zn	—	17.5	65.0	17.5

<sup>1</sup>The higher near value for milk production was used to determine NRC requirements.

Table 2. Dietary mineral contents and Maximum Tolerable Levels (MTL).

Mineral Content	Mean±SD	Min	Max	MTL	Dairies over MTL (%)
Ca	0.81±0.14	0.47	1.13	1.5	—
P	0.44±0.06	0.32	0.58	0.7	—
Mg	0.35±0.05	0.27	0.47	0.6	—
K	1.81±1.25	1.18	2.36	2.0	5
Cl	0.65±0.21	0.33	1.50	—	—
Na	0.47±0.14	0.24	1.10	—	—
Na+Cl	1.12±0.32	0.68	2.6	3.0	—
S	0.23±0.05	0.18	0.38	0.3	47
Cu <sup>2</sup>	1.7±7.09	8.44	37.3	40	—
Fe	3.90±145.1	198.3	770	500	15
Mn	72.8±18.12	40.5	113.3	2,000	—
Se	0.45±0.11	0.22	0.75	5	—
Zn	75.8±21.53	38.5	139.5	900	—

<sup>1</sup> Individual values (Na and Cl) were added to compare MTL for NaCl (lactating cows)  
<sup>2</sup> Sulfur MTL value for high concentrate diets (NRC 2005)  
<sup>3</sup> Assuming normal concentrations of molybdenum and sulfur

## SUMMARY & CONCLUSIONS

Dietary Ca and Se content were below 80% of the NRC requirements in 2.5% of the dairies and in 7.5% for Cu.

The dietary mineral content per farm was 120% or more of the NRC requirements in 57.5% and in 100% of the dairies, depending on the mineral.

Minerals considered a concern because of their potential effect on crop yields and the environment (NRC 2005) were over 120% requirements in more than 60% of the dairies.

Two minerals (Fe and Mn) were over 200% NRC requirements in all dairies evaluated in this study.

The maximum Tolerable Levels for K, S, Fe, were exceeded in 5%, 47% and 15% of the dairies respectively (NRC, 2005).

This survey indicates that there is opportunity to adjust dietary mineral content in lactating dairy cow diets, reducing feed cost and mineral excretion.

## ACKNOWLEDGEMENTS

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Larry Burton, working with cow milkers for water meter estimators

## OBJECTIVES

Evaluate the dietary mineral content of lactating dairy cow diets in commercial dairy farms according to:

1. The NRC (2001) requirements.
2. The Maximum Tolerable Levels of the NRC (2005).