Forage Quality & Toxicology

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26 pastures
20 hay stacks
15 corn silage piles

Table 1. Minerals with a maximum tolerable level (MTL) established for cattle by NRC (2005)[1].

Mineral	Health Concern[2]	MTL[3]	Mineral	Health Concern[2]	MTL[3]
Excessive exposure possible			**Excessive exposure is rare**		
Calcium (Ca)	Medium	1.5%	**Aluminum (Al)**	Low	1000 ppm
Cobalt (Co)	Low	25 ppm	**Boron (B)**	Medium	150 ppm
Copper (Cu)	High	40 ppm	**Bromine (Br)**	Medium	200 ppm
Iodine (I)	Low	50 ppm	**Cadmium (Cd)**	High	10 ppm
Iron (Fe)	Medium	500 ppm	**Chromium (Cr)**	Low	100 ppm
Magnesium (Mg)	Low	0.6%	**Lead (Pb)**	High	100 ppm
Manganese (Mn)	Low	2000 ppm	**Lithium (Li)**	Low	25 ppm
Molybdenum (Mo)	High	5 ppm	**Mercury (Hg)**	High	2 ppm
Phosphorus (P)	Medium	0.7%	**Nickel (Ni)**	Low	100 ppm
Potassium (K)	Medium	2%	**Silicon (Si)**	Low	0.2%
Selenium (Se)	High	5 ppm	**Strontium (Sr)**	Low	2000 ppm
Salt (NaCl)	High	3.0%	**Tin (Sn)**	Low	100 ppm
Sulfur (S)	High	0.4%	**Tungsten (W)**	Low	20 ppm
Zinc (Zn)	Medium	500 ppm	**Vanadium (V)**	Low	500 ppm

[1]The NRC established MTL for antimony, barium, bismuth, rare earth elements, rubidium, silver, titanium, and uranium for some species of animals but not cattle.
[2]Concern considers both the likelihood of a toxic exposure (including accidental) and severity of animal response.
[3]The MTLs are for cattle and are on a dry matter basis. Numerous factors affect MTLs, including bioavailability of mineral, duration of exposure, animal factors, and water concentrations. Data in this table should not be the sole source of information; readers should consult the appropriate section of NRC (2005).

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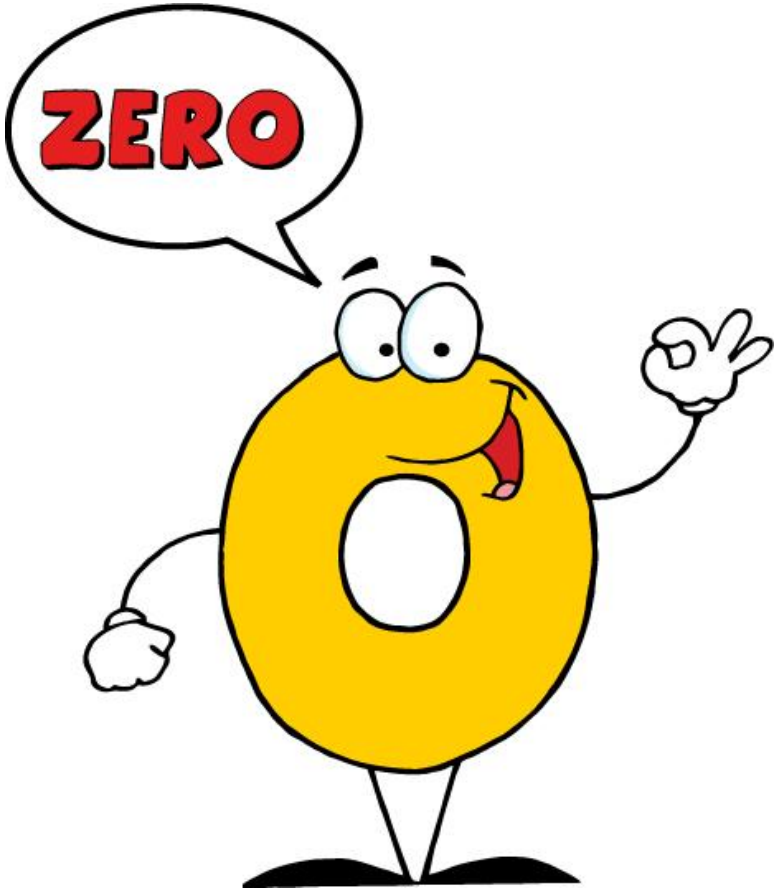
Plus Arsenic- MTL = 30 ppm

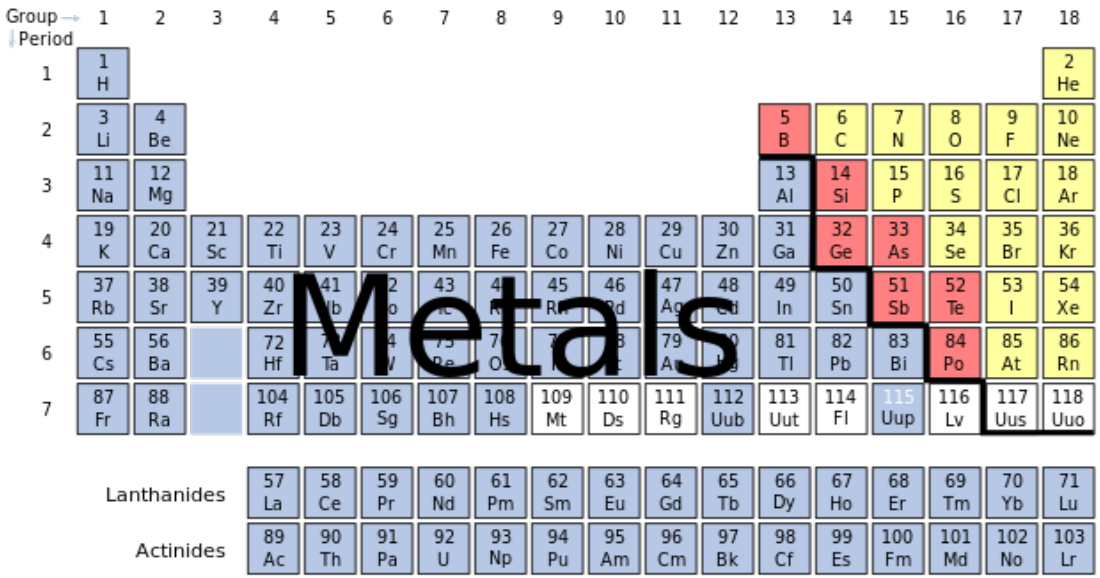
Heavy Metals- not detected

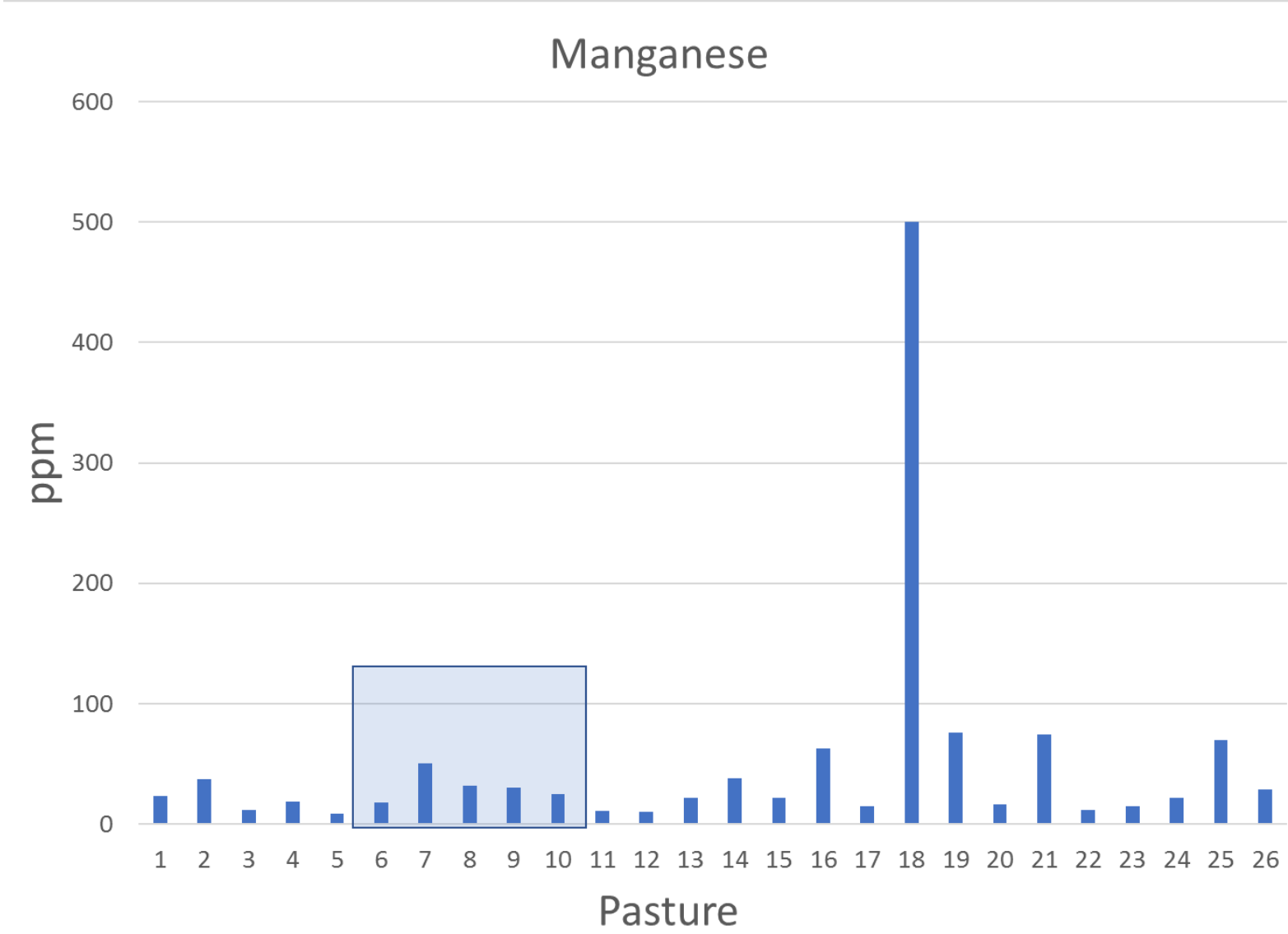
- Lead
- Mercury
- Arsenic
- Molybdenum
- Cadmium

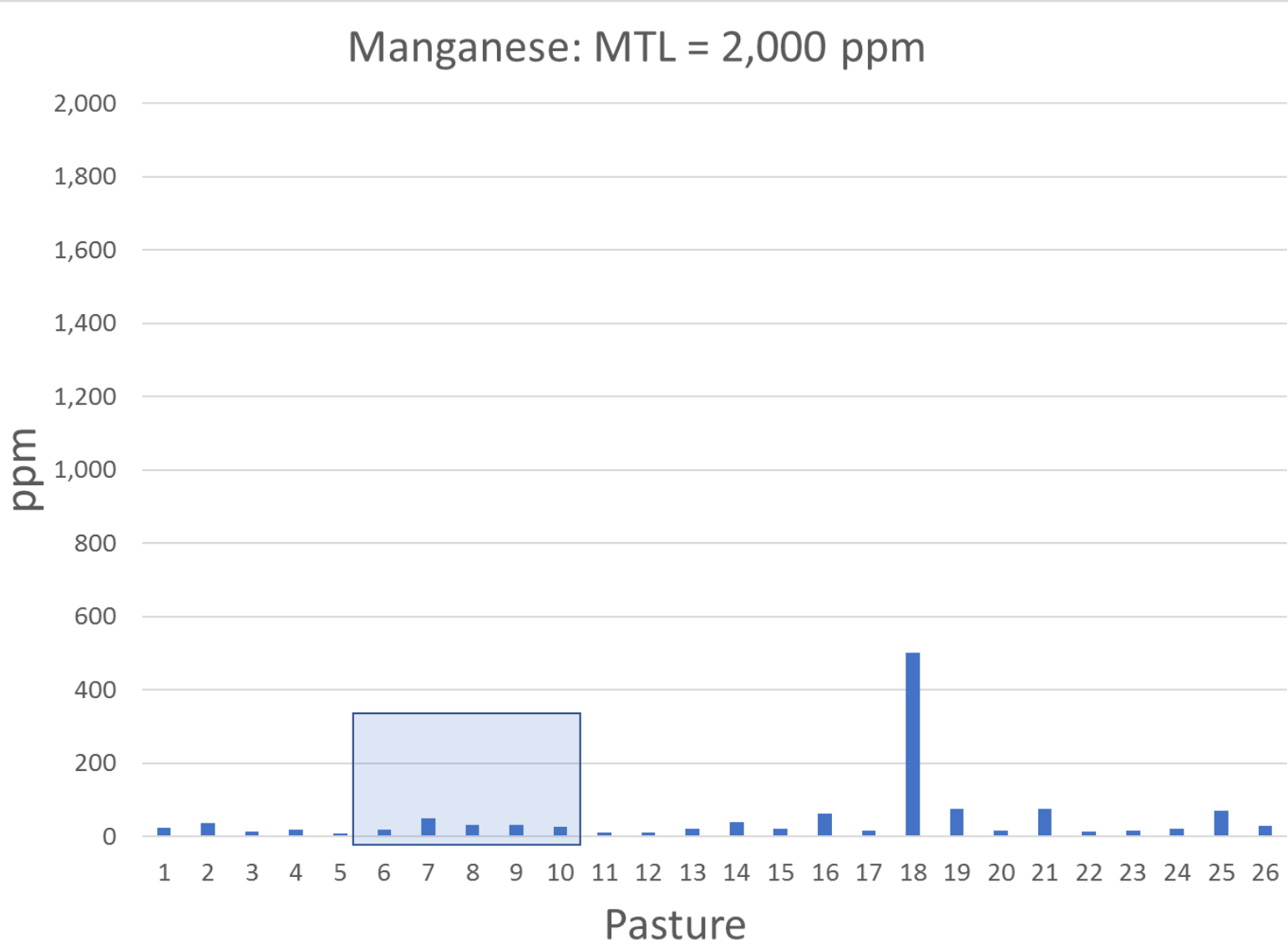


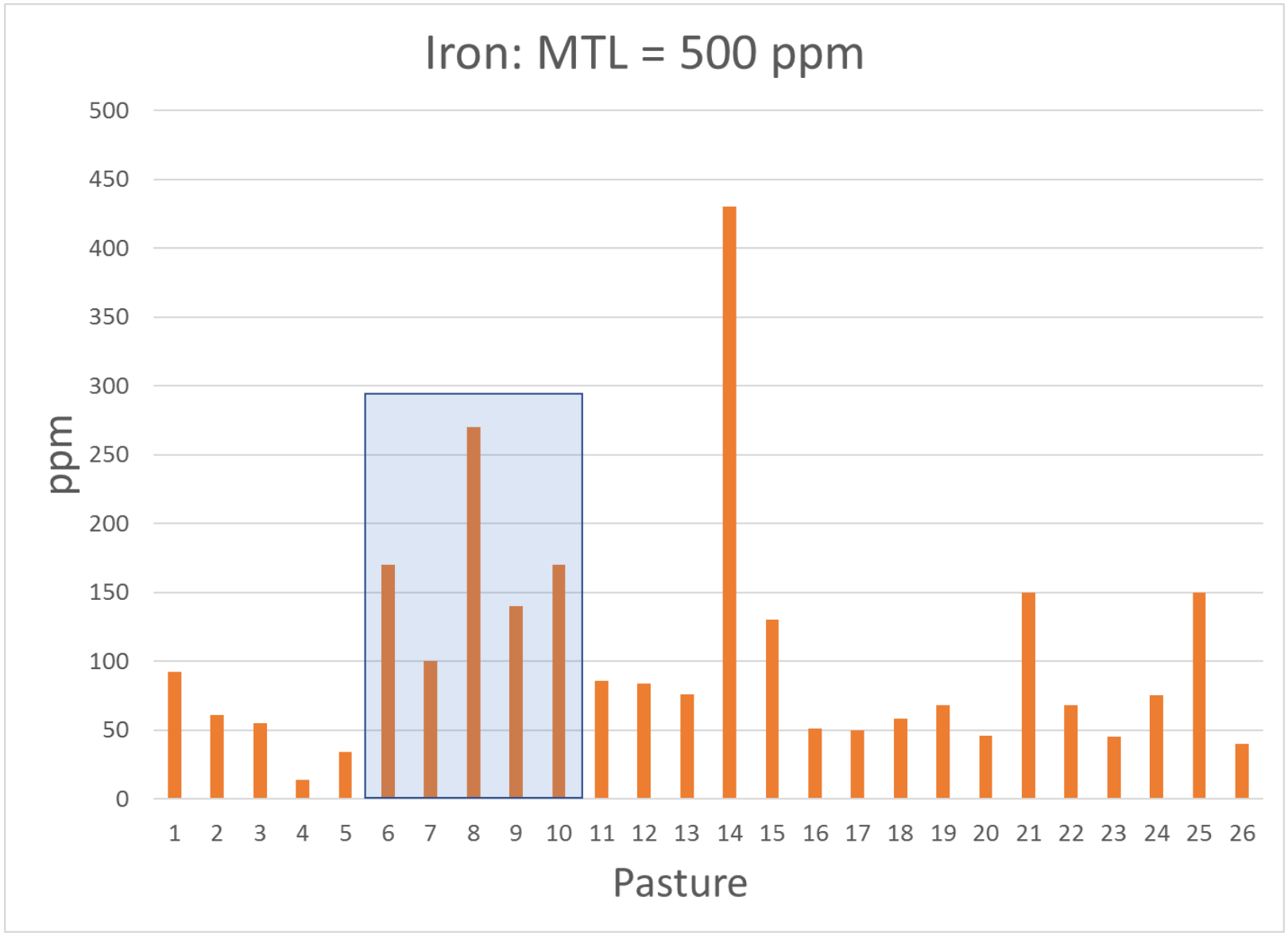
Low Levels

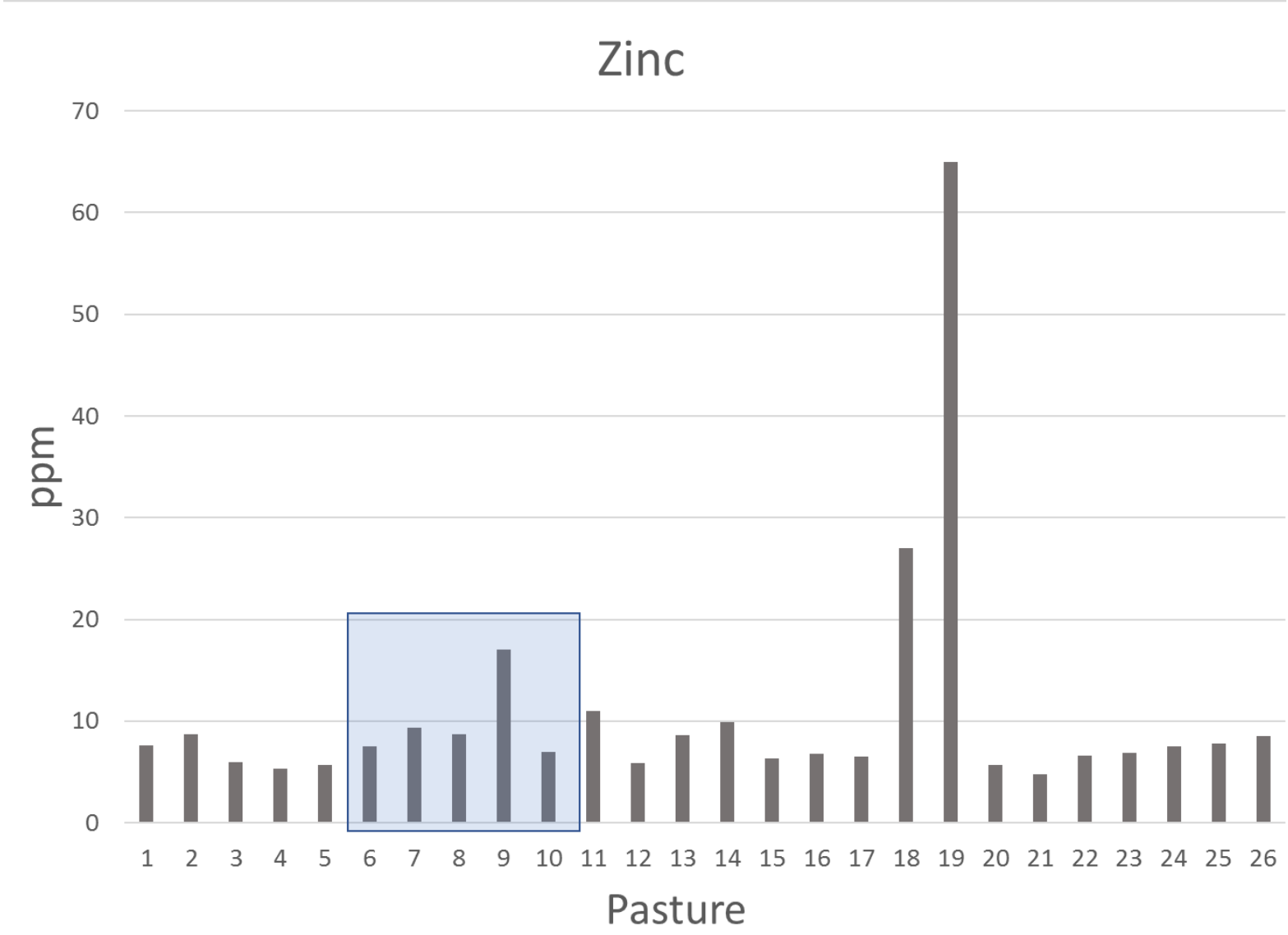
- Manganese
- Iron
- Zinc
- Copper

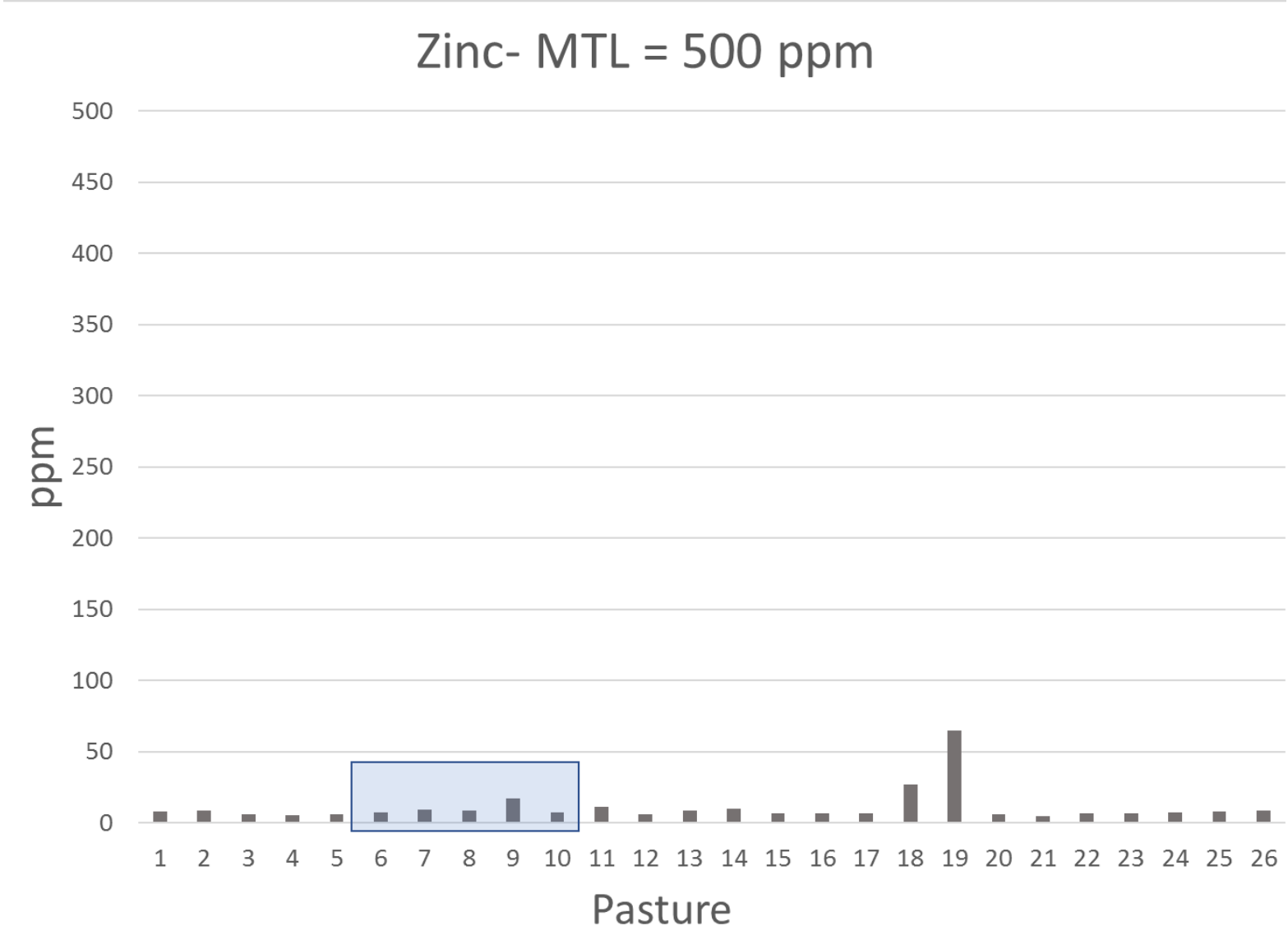


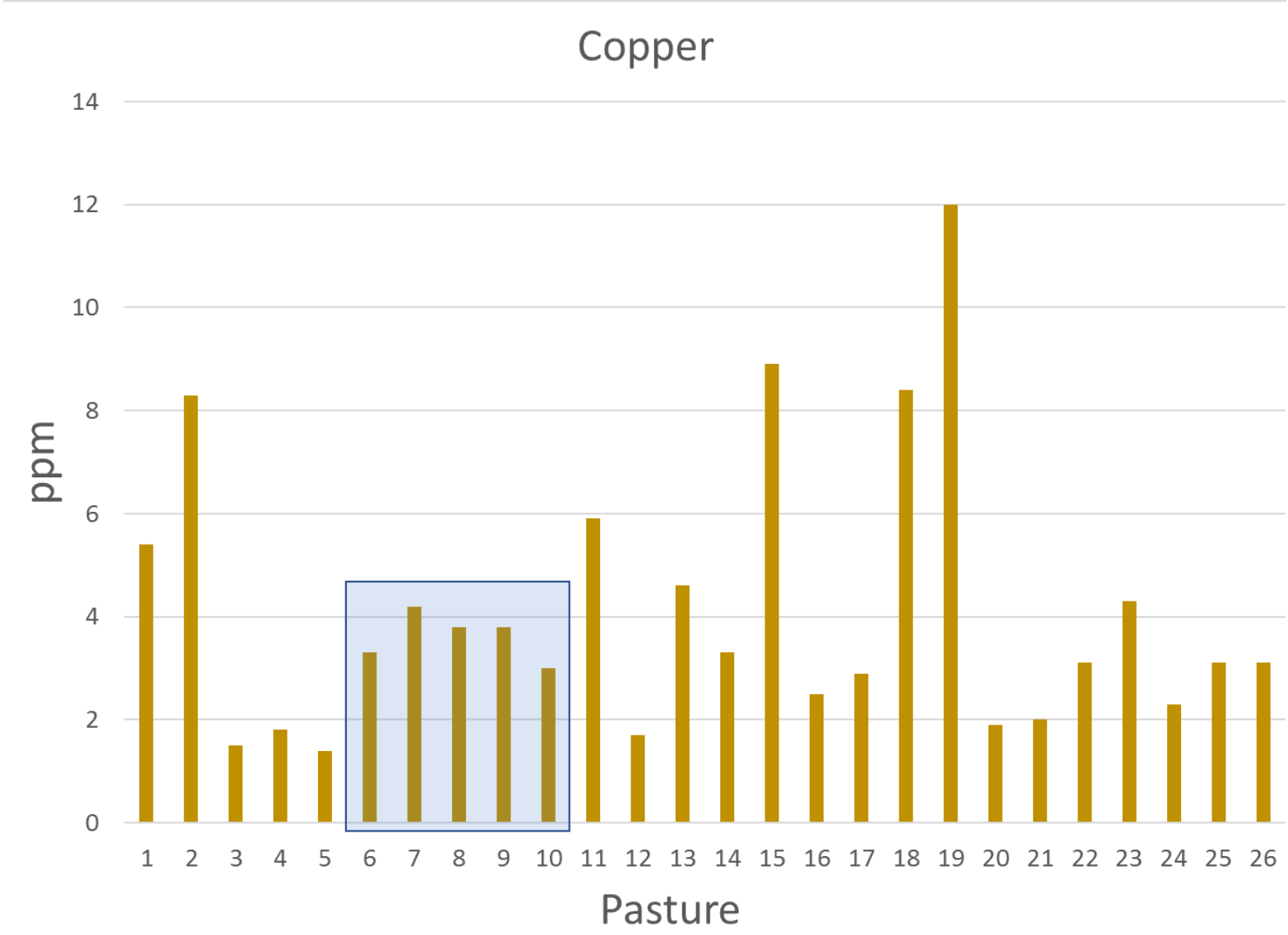

Manganese
600
500
400
300
200
100
0
ppm
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Pasture

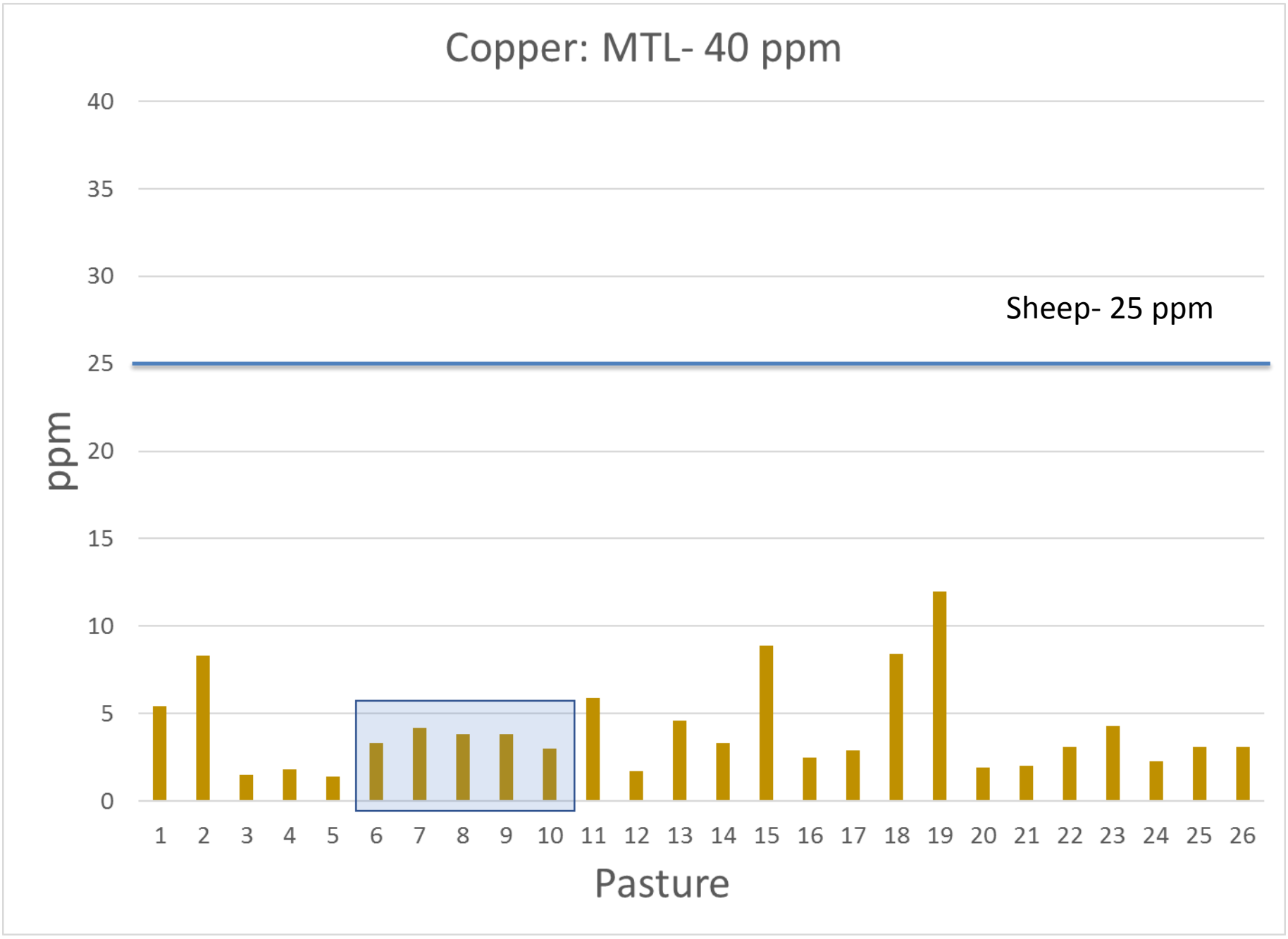

Manganese: MTL = 2,000 ppm
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
ppm
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Pasture

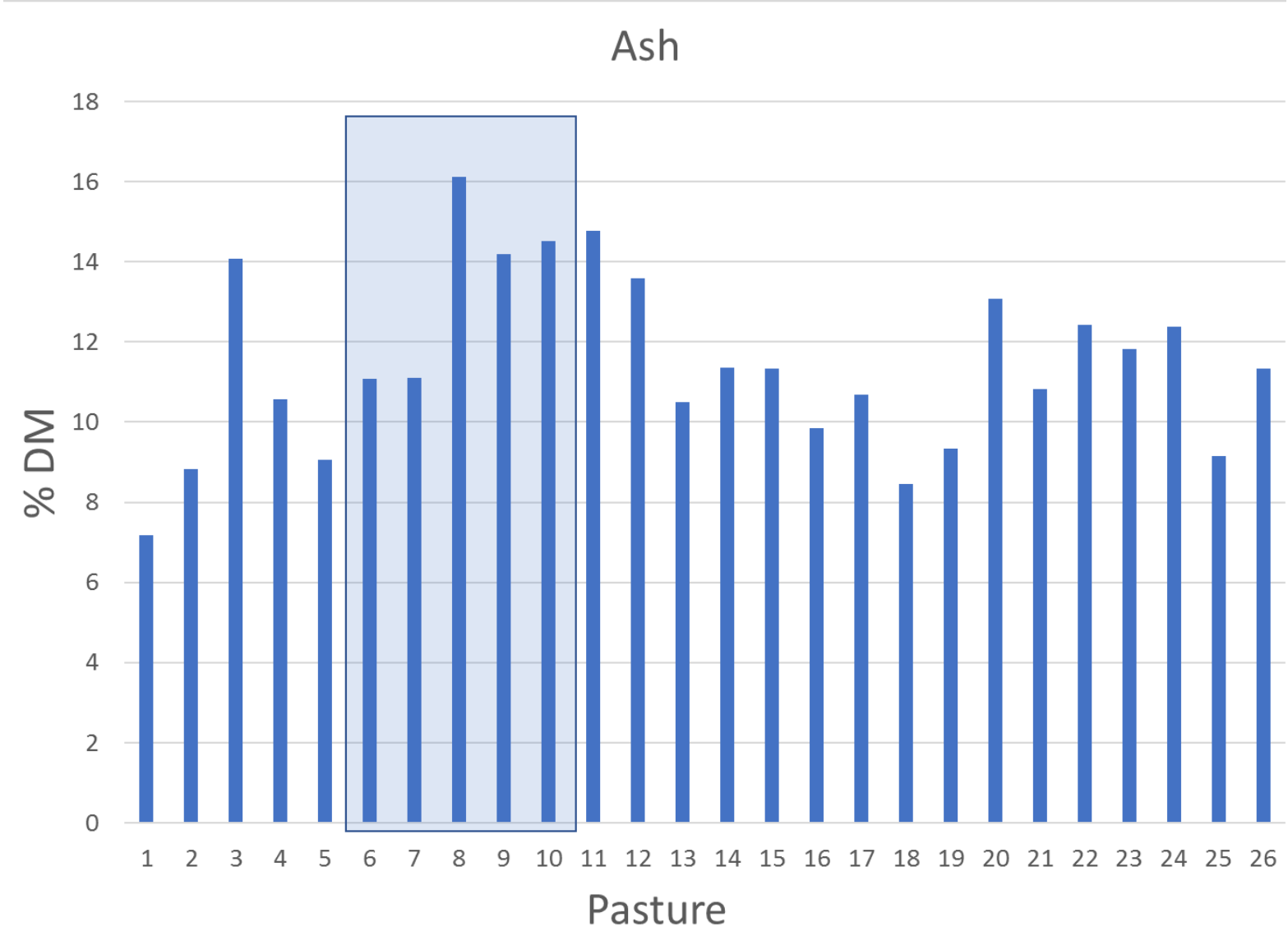

Iron: MTL = 500 ppm
500
450
400
350
300
250
200
150
100
50
0
ppm
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Pasture


Zinc
70
60
50
40
30
20
10
0
ppm
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Pasture


Zinc- MTL = 500 ppm
500
450
400
350
300
250
200
150
100
50
0
ppm
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Pasture


Copper
14
12
10
8
6
4
2
0
ppm
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Pasture


Copper: MTL- 40 ppm
40
35
30
25
20
15
10
5
0
ppm
Sheep- 25 ppm
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Pasture


Ash
% DM
18
16
14
12
10
8
6
4
2
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Pasture

GC/LC-Mass Spec

- Screening for organic chemicals
- Detect large number of organic compounds belonging to diverse chemical classes
  - Pesticides
  - Environmental contaminants
  - Drugs
  - Other natural products
- Samples processed at UC Davis CAHFS Lab

GC/LC-Mass Spec

- Subset of 13 pasture samples – all 5 Butte County sites
- 2 “hits”
  - Shasta County
    - Ethoprop
    - Caffeine
- 11 negative

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What's next

- Follow-up pasture sampling?
- Soil?
- Corn Silage & Hay results

Project Team & Funding

Cooperative Extension Advisors: Betsy Karle, Tracy Schohr, Larry Forero, Josh Davy, Mariano Galla, David Lile, Dan Macon, John Harper, Jeff Stackhouse, Jennifer Heguy, Nick Clark

UC Davis Faculty/Extension Specialist: Deanne Meyer, Ed DePeters, Robert Poppenga, Thomas Young

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