A photograph of a laboratory bench. The bench is cluttered with various scientific instruments and supplies. On the left, there are several pipettes and a rack of pipette tips. In the center, there is a spectrophotometer with a computer monitor mounted on a stand above it. To the right, there is a large piece of equipment, possibly a centrifuge or a large pipette, with a flexible duct above it. The bench is supported by wooden cabinets. The background shows a typical laboratory setting with other equipment and a fire extinguisher on the wall.

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Soil and Plant Testing for Alfalfa

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Alfalfa Nutrient Removal

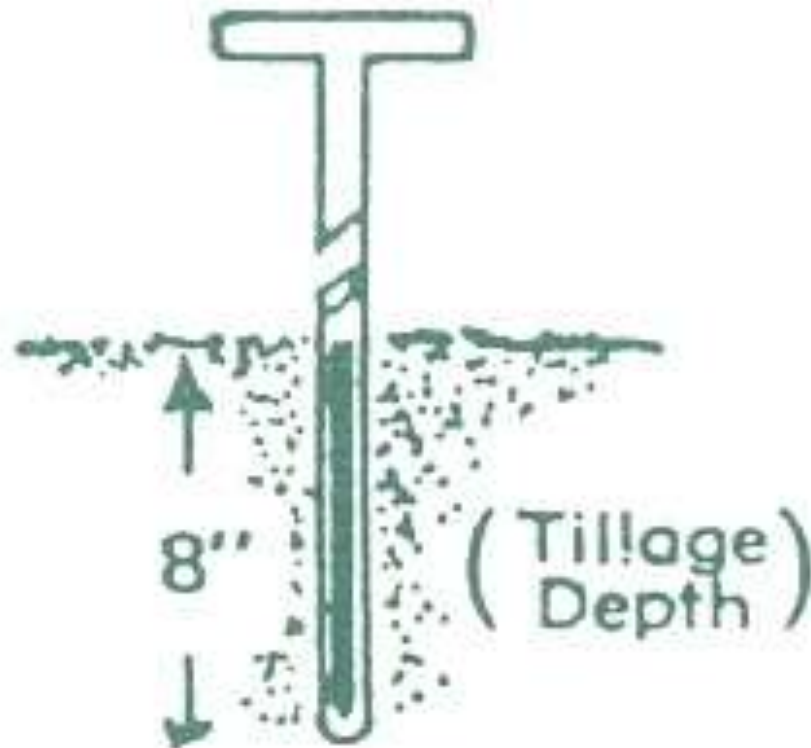
<u>Nutrient</u>	<u>Ibs/Ton</u>	<u>Ibs/ 6 Tons</u>
Nitrogen, N	55	330
Phosphorus, P ₂ O ₅	12	72
Potassium, K ₂ O	50	300
Calcium, Ca	28	168
Magnesium, Mg	5.3	32
Sulfur, S	5.0	30

Alfalfa Nutrient Removal

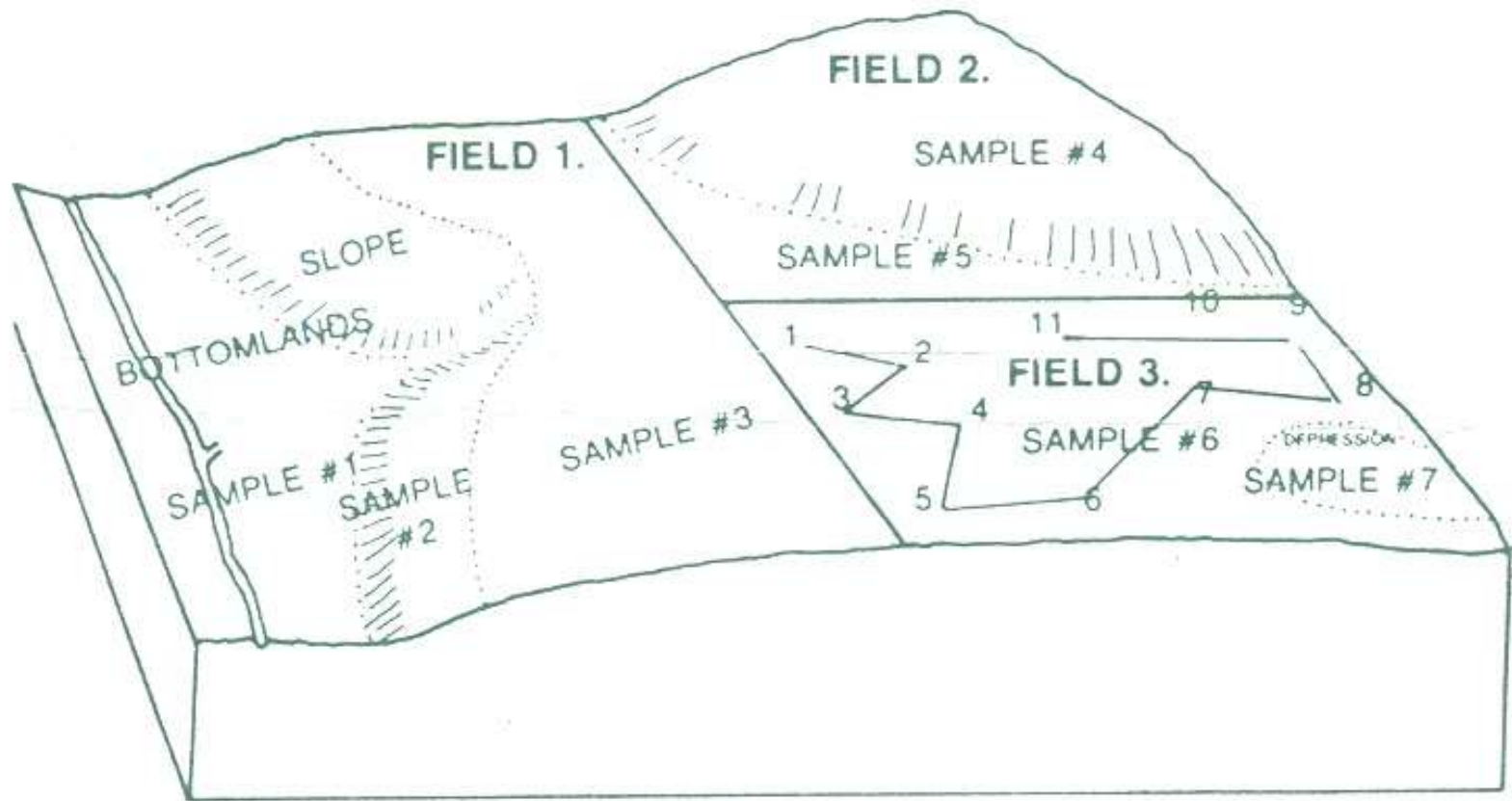
<u>Nutrient</u>	<u>lb/Ton</u>	<u>lbs/ 6 Tons</u>
Copper, Cu	0.015	0.09
Manganese, Mn	0.11	0.66
Iron, Fe	0.33	2.0
Zinc, Zn	0.11	0.66
Boron, B	0.08	0.48
Molybdenum, Mo	0.002	0.01

Soil Sample for Fertility

SOIL TUBE



Field & Zone Sampling



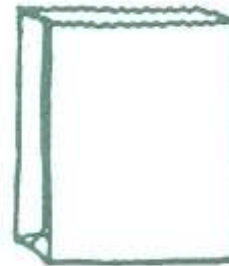
Clean Buckets and Sample Bags



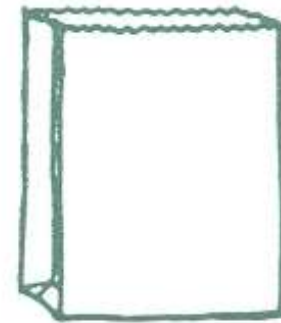
Top Soil 8"



Sub Soil 8-36"



Top Soil Bag



Subsoil Bag

USE PLASTIC PAILS

Grid Sampling

- New technology using GPS, etc
- Point sampling usually every 2.5 acre
- Measures variability within the field
- Variable rate apply phosphate, potash, zinc and lime

Grid Sampling

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	27	28	29	30	31	32

Nitrogen Deficiency

Light green to yellow color and spindly growth.

Plant Analysis (top 1/3 of the plant) Hay

– Deficient	<3.20 % N	<2.4 % N
– Low	3.20 – 3.80 % N	2.4 – 2.8 % N
– Sufficient	3.81 – 4.60 % N	2.9 – 3.2 % N
– High	>4.60 % N	>3.2 % N

Phosphorus Deficiency: Blue-green color, stiff, stunted and erect growth. Leaflets often fold together, and the undersides and stems may be red or purplish.



Phosphorus Plant Analysis

- Deficient <math><0.20\% \text{ P}</math>
- Low 0.20 - 0.24 % P
- Sufficient 0.25 – 0.40 % P
- High >0.40 % P

Phosphorus Recommendations for Alfalfa

Soil P Test, ppm P		4 ton /A	8 ton/A
M P-3 or B P-1		lbs P ₂ O ₅ /A	lbs P ₂ O ₅ /A
0-5	V Low	90 – 120	110 – 140
6-12	Low	60 – 85	80 – 105
13-25	Medium	30 – 55	60 – 75
26-50	High	0 – 25	20 – 45
>50	V High	None	None

Potassium Deficiency: White spots around edge of leaf starting with lower leaves. Leaves will eventually turn completely yellow and die.



Another look at Potassium Deficiency



Potassium Plant Analysis

- Deficient <1.70 % K
- Low 1.70 – 2.10 % K
- Sufficient 2.11 – 3.60 % K
- High >3.60 % K

Potassium Recommendations for Alfalfa

Soil K Test, ppm K		4 ton/A	8 ton/A
NH ₄ Acetate		lbs K ₂ O/A	lbs K ₂ O/A
0-40	V Low	130 – 210	155 - 235
41-80	Low	80 – 125	105 - 150
81-120	Medium	45 – 75	70 - 100
121-200	High	25 – 40	50 - 65
>200	V High	None	None

Sulfur Deficiency: Light green, similar to N deficiency, spindly stems and weak growth.



Sulfur Plant Analysis

- Deficient <math><0.14\% S</math>
- Low $0.14 - 0.20\% S$
- Sufficient $0.21 - .30\% S$
- High $>0.30\% S$

Sulfur Recommendations for Alfalfa

Yield Goal Ton/A	Sulfate soil test, ppm SO ₄ -S		
	6 ppm	9 ppm	12 ppm
4	8	0	0
6	19	11	4
8	30	22	15
10	41	33	26

Sulfur Recommendation Example

Alfalfa 8 Ton/A Yield Goal

Sulfur Requirement is 5.5 lbs S/ton

Total S Required is 44 lbs S/A

Sulfate Soil Test is 8 ppm S

$8 \text{ ppm} \times .3 \times 8 \text{ inches} = 19 \text{ lbs S/A}$

Recommendation is 25 lbs S/A

Boron Deficiency: Yellowing of leaves, shortened main stem growth making a dense top.



More Boron Deficiency

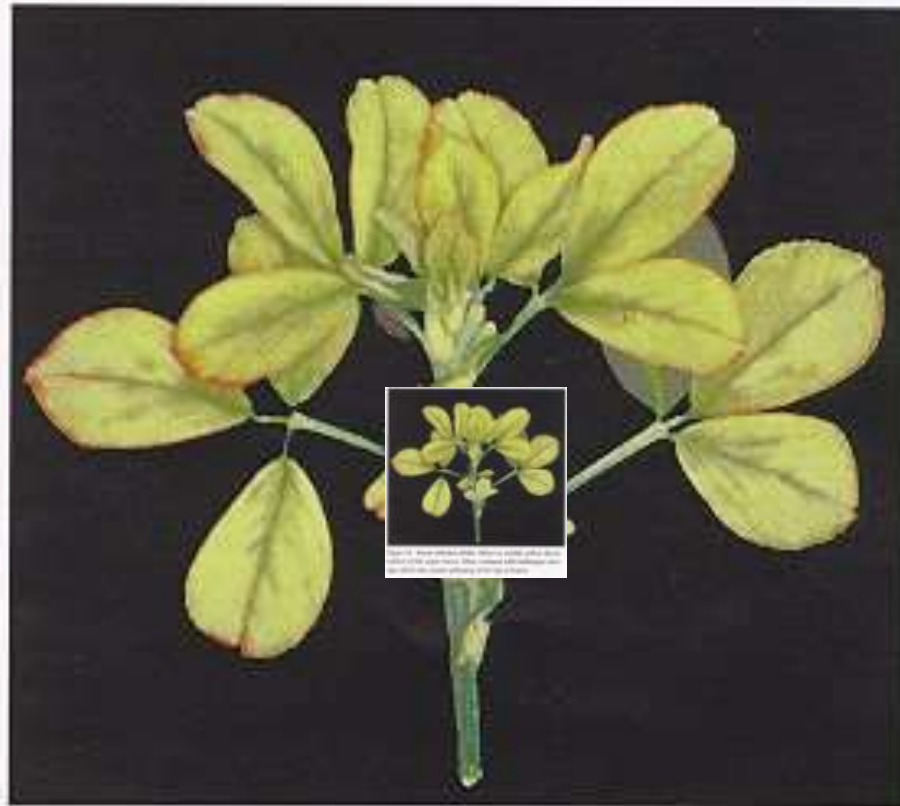


Figure 24. Boron-deficient alfalfa. Yellow to reddish yellow discoloration of the upper leaves. Often confused with leafhopper damage, which also causes yellowing of the tips of leaves.

Boron Plant Analysis

- Deficient <10 ppm B
- Low 10 – 20 ppm B
- Sufficient 21 – 50 ppm B
- High >50 ppm B

Boron Soil Test and Recommendations

<u>Boron Soil Test, ppm</u>	<u>Rating</u>	<u>Boron Rate Lbs B/A</u>
0 – 0.25	Low	0.5 – 3.0
0.26 – 0.50	Medium	0.0 – 1.7
0.51 +	High	0

Alfalfa, clover, peanuts, cotton and sugar beets require more boron than other crops.

Molybdenum Deficiency

- Pale green and stunted as with nitrogen deficiency
- Plant Analysis
 - Deficient <0.05 ppm Mo
 - Low 0.05 – 0.10 ppm Mo
 - Sufficient 0.11 – 2.00 ppm Mo
 - High >2.00 ppm Mo

Molybdenum Application

- Foliar Treatment
 - 2 ounces of Sodium Molybdate per acre in 30 gallons of water as a foliar
- Seed Treatment
 - 1/2 ounce of Sodium Molybdate per bushel

Liming or Correcting Soil Acidity



Calcium Deficiency

- Impaired root growth or rotting
- Petioles collapse on youngest mature leaves
- Plant Analysis
 - Deficient < 0.51 % Ca
 - Low 0.51 – 1.01 % Ca
 - Sufficient 1.01 – 2.60 % Ca
 - High >2.61 % Ca

Magnesium Deficiency

- Interveinal chlorosis of lower leaves
- Margins initially remain green
- Plant Analysis
 - Deficient <math><0.15\% \text{ Mg}</math>
 - Low $0.15 - 0.25\% \text{ Mg}$
 - Sufficient $0.26 - 0.70\% \text{ Mg}$
 - High $>0.70\% \text{ Mg}$

Iron Deficiency: Interveinal chlorosis of youngest leaves, bleached appearance.



Zinc, Iron, Manganese, Copper

- These nutrients are rarely deficient in alfalfa.
- Plant analysis may be a good way to evaluate availability of these 4 nutrients.
- Plant Analysis (sufficient)
 - Zinc 16 – 70 ppm Zn
 - Iron 36 – 300 ppm Fe
 - Manganese 31 – 150 ppm Mn
 - Copper 5 – 16 ppm Cu

Thank You