Soil Acidity impact on Nutrients

Centra In-Service

Causes of Soil Acidity

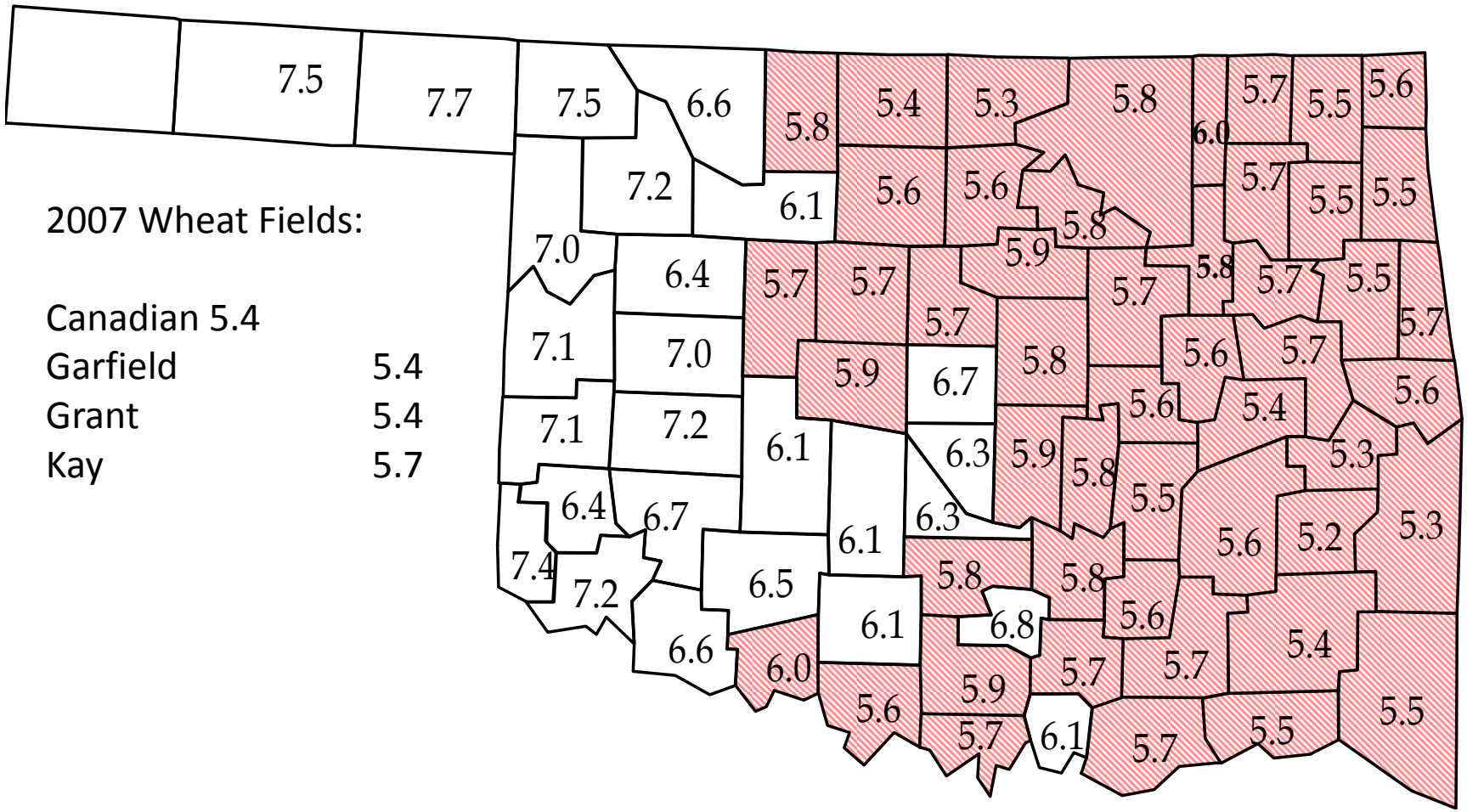
- Excessive rainfall
- Parent material from which soils develop
- Organic matter decay
- Harvest of high yielding crops
- Nitrogen fertilizer

Problems with Soil Acidity

- Nutrient availability reduced
- Toxic elements become more soluble
  - Aluminum
    - Root pruning
    - Blocks sites of uptake on roots
    - Binds with P
  - Manganese
  - H+

Plant grown under aluminum toxic conditions (acid soil conditions) compared with a normal plant the same age.

46% of the Oklahoma tested samples had a pH of <6.0 (PPI 2005).



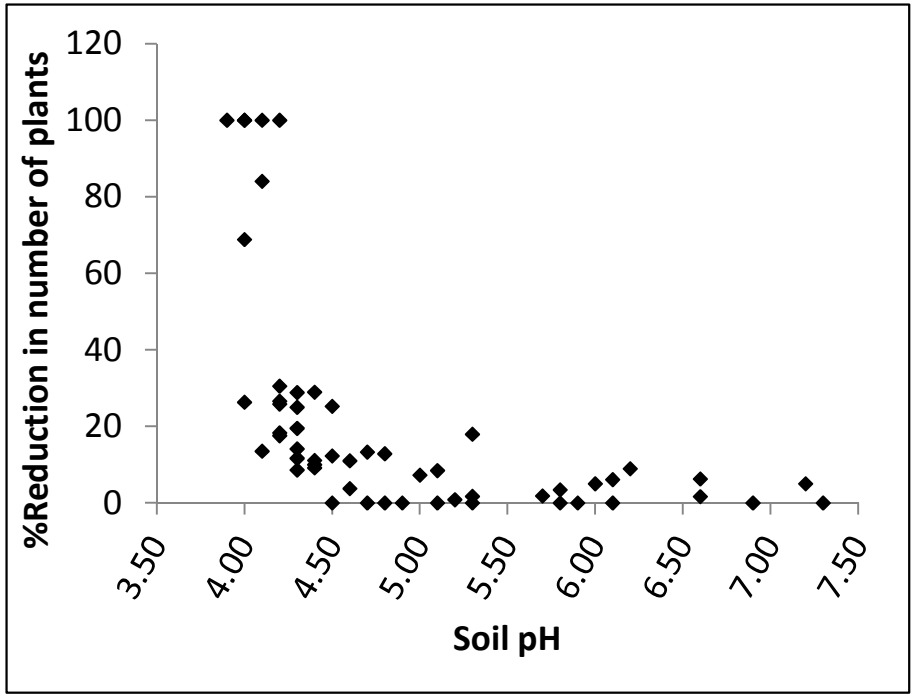
2007 Wheat Fields:

Canadian 5.4

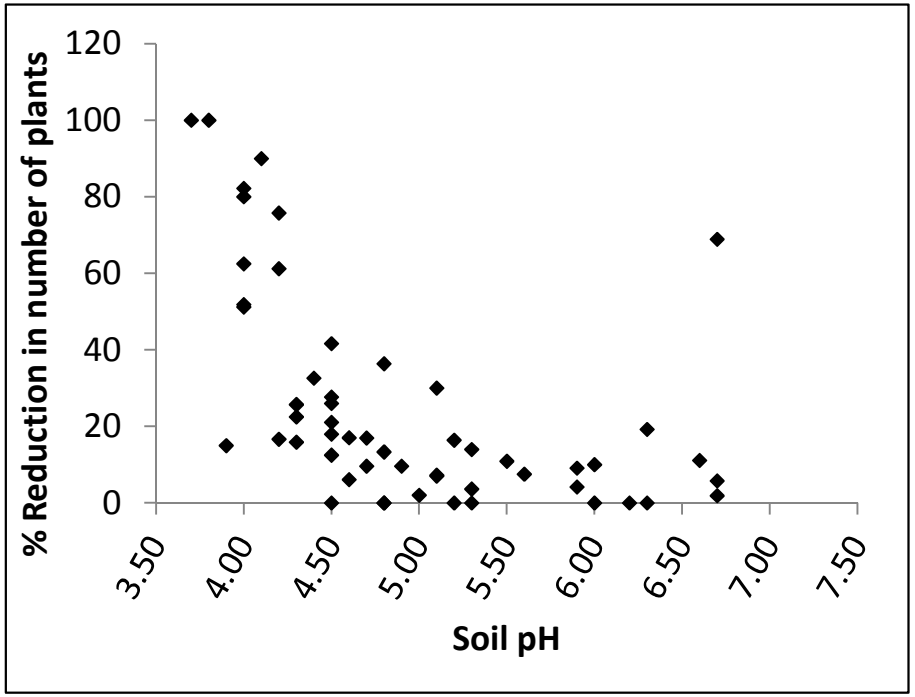
Garfield	5.4
Grant	5.4
Kay	5.7

Median Soil pH Values of OK Counties (all Ag. soils)

Emergence and Number of Heads at Harvest

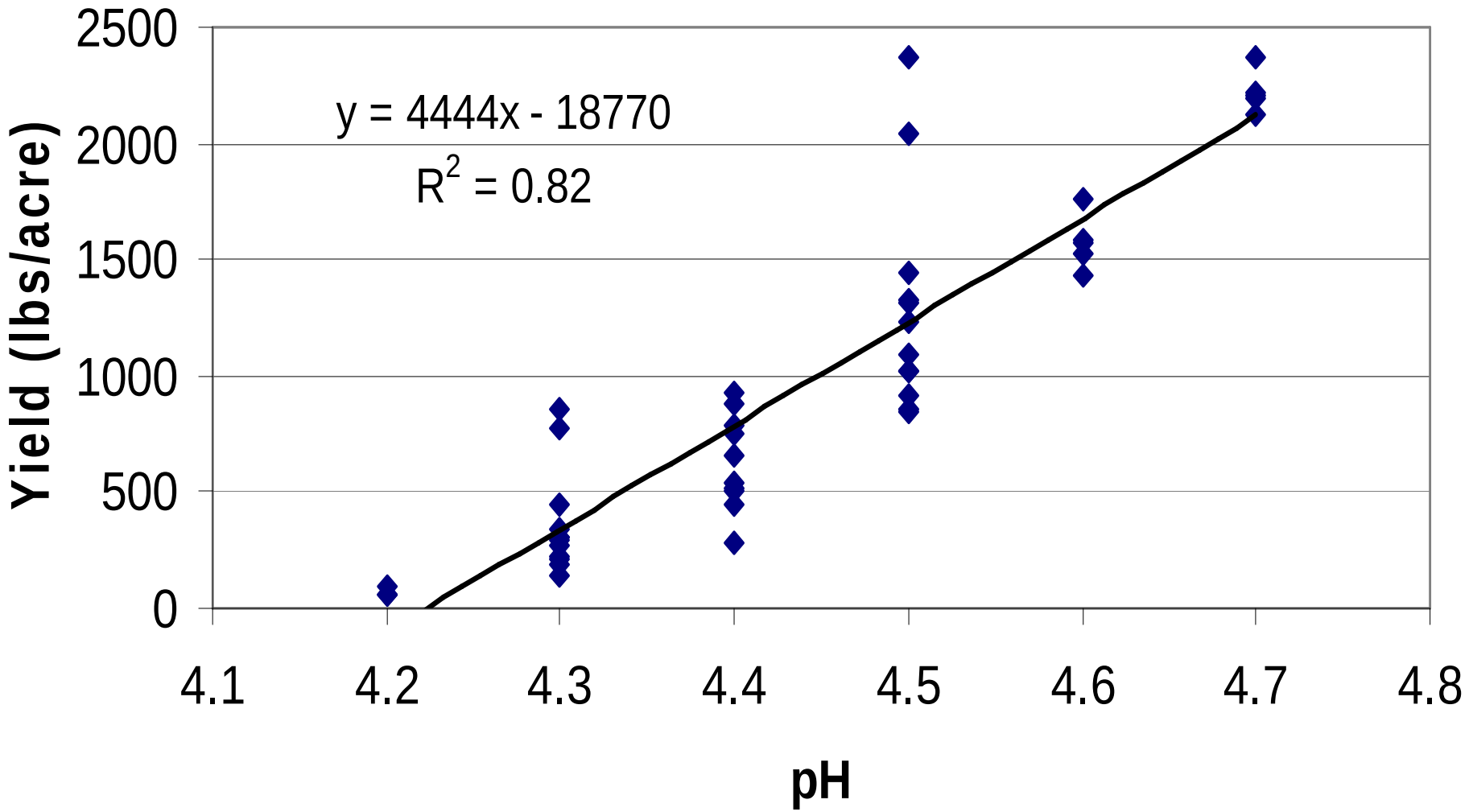


Grain sorghum-Perkins, Lahoma, and Haskell, OK



Sunflower-Perkins, Lahoma, and Haskell, OK

Soil Acidity Reduces Forage Yield



Wheat

Soil pH	Relative Yield (% of Max)	Actual Yield (bu/acre)	Loss ($/acre)
3.8	0	0	320.00
4.1	30%	12	224.00
4.5	60%	24	128.00
5.0	85%	34	48.00
5.5	95%	38	16.00
6.0	100%	40	0.00

$8.00 per bushel

Corn

Soil pH	Relative Yield (% of Max)	Actual Yield (bu/acre)	Loss ($/acre)
4.3	32%	48	714.00
4.6	74%	110	280.00
4.8	80%	120	210.00
5.3	88%	132	126.00
5.6	96%	144	42.00
6	100%	150	0.00

$7.00 per bushel

Grain Sorghum

Soil pH	Relative Yield (% of Max)	Actual Yield (bu/acre)	Loss ($/acre)
4.0	40%	32	288.00
4.3	50%	40	240.00
4.6	60%	48	192.00
4.9	70%	56	144.00
5.1	80%	64	96.00
5.6	95%	76	24.00
5.71	100%	80	0.00

$6.00 per bushel

Sunflower

Soil pH	Relative Yield (% of Max)	Actual Yield (lb/acre)	Loss ($/acre)
4.3	40%	580	261.00
4.5	50%	725	217.50
4.7	60%	870	174.00
4.9	70%	1015	130.50
5.1	80%	1160	87.00
5.4	95%	1378	22.00
5.5	100%	1450	0.00

$0.30 per lb

Canola

Soil pH	Relative Yield (% of Max)	Actual Yield (bu/acre)	Loss ($/acre)
4.3	0%	0	480.00
4.5	10%	4	432.00
4.7	23%	9	372.00
5.0	34%	14	312.00
5.3	59%	24	192.00
5.7	95%	38	24.00
5.8	100%	40	0.00

$12.00 per bushel

Soil pH 4.0

Soil pH 4.1

Soil pH 4.6

Soil pH 5.3

Soil pH 5.8

Soil pH 6.1

Soil pH 4.1

Soil pH 4.0

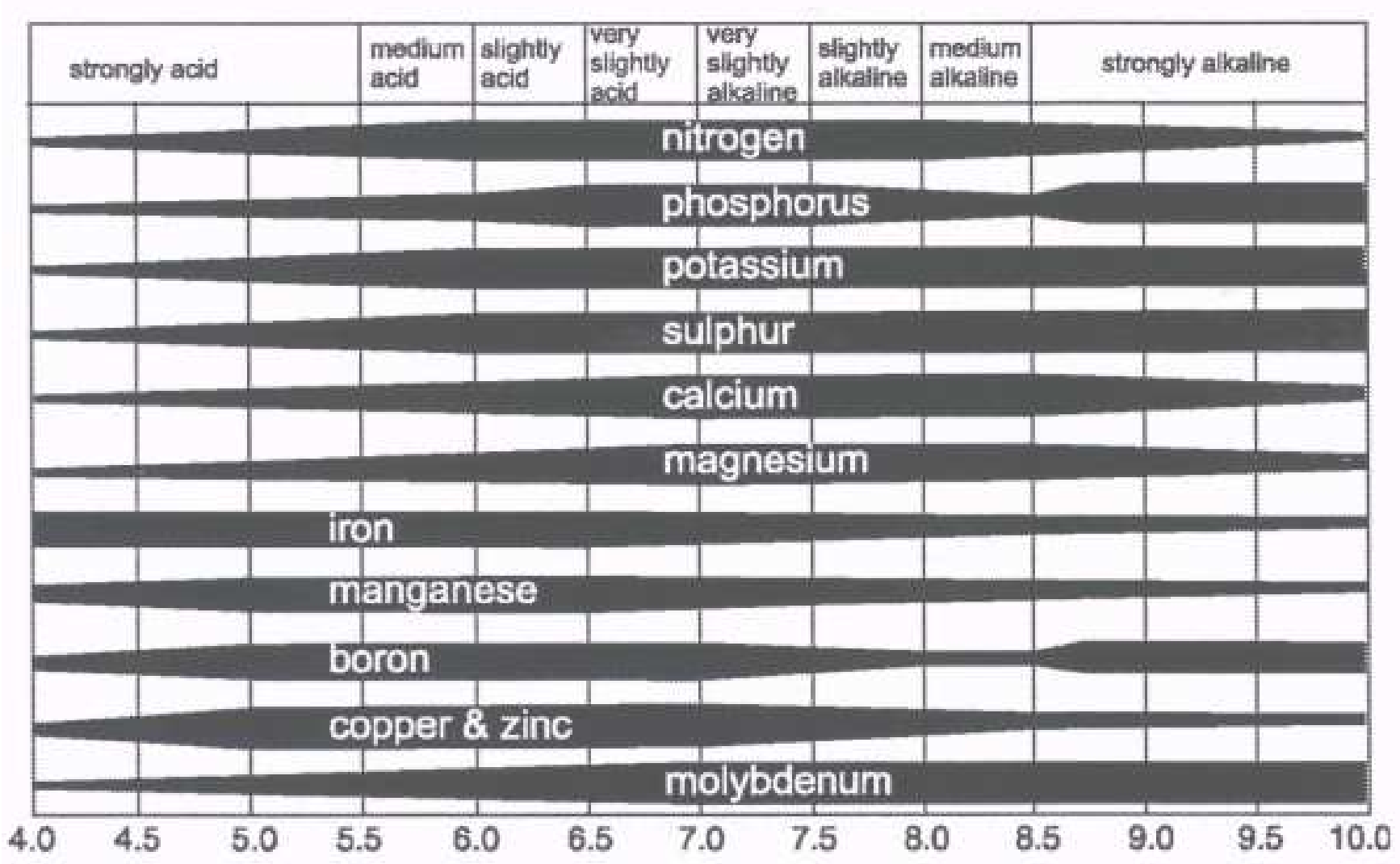
Soil pH 4.7

Soil pH 5.1

Soil pH 5.5

Soil pH 6.7

pH and Nutrients



Phosphorus Deficiency

Phosphorus is **mobile** in the plant: Lower/Older Leaves

Purpling of the leaf margins or base of stems.
Symptoms similar too…

Acidic soils

Iron Deficiency

Iron is **immobile** in the plant: Upper/Newer leaves
Intervienal chlorosis, stripes narrower than zinc and extend full length of leaf
Calcareous Soils pH >8

Zinc Deficiency

Zinc relatively **immobile** in plant: Upper/Newer leaves
Purple margins, inward purple blotching,
bleached bands on either side of midrib near base, intervienal chlorosis
Acidic, Sandy soils, Calcareous pH>8

Manganese Deficiency

Manganese is relatively **immobile** in plant, but can move in xylem sap.
Interveinal chlorosis, very similar to Fe, Mg, N.
Severe deficiencies have brown specs and bronzing
Limited at high pH, Calcareous soils.

Molybdenum Deficiency

Molybdenum is readily translocated; **whole plant**

Related to N metabolism, yellowing, stunting, interveinal mottling

Cupping of upper leaves

Soil with low pH and high Fe and Al.

Lime required to neutralize the soil acidity produced by fertilizers if all ammonium-N is converted to nitrate-N.

Nitrogen source	*Composition*	*Lime required (lb $CaCO_3$ / lb N)*
Anhydrous ammonia	82-0-0	1.8
Urea	46-0-0	1.8
Ammonium nitrate	34-0-0	1.8
Ammonium sulfate	21-0-0-24	5.4
Monoammonium phosphate	10-52-0	5.4
Diammonium phosphate	18-46-0	3.6
Triple super phosphate	0-46-0	0.0

Adapted from Havlin et al., 1999.