Field Crops

Relative Micronutient Requirements of Wisconsin Field crops [1]

Crop	Boron	Copper	Manganese	Zinc
Alfalfa, established	High	Medium	Low	Low
Alfalfa, seedling	High	Medium	Low	Low
Barley, grain	Low	Medium	Medium	Medium
Canola	High	Medium	Medium	Medium
Clover, Red	Medium	Medium	Low	Low
Corn, grain	Low	Medium	Medium	High
Corn, silage	Low	Medium	Medium	High
Corn, sweet	Low	Medium	Medium	High
Millet	Low			
Oats, grain	Low	Medium	High	Low
Pasture, legume-grass	High	Medium	Low	Low
Rye, grain	Low	Low	Low	Low
Small grain silage	Low	Medium	High	Low
Sorghum, grain	Low	Medium	High	High
Sorghum-sudan, forage	Low	Medium	High	Medium
Soybean, grain	Low	Low	High	Medium
Sunflower	High	High		
Wheat, grain	Low	Medium	High	Low

Vegetable and Fruit Crops

Relative Micronutient Requirements of Wisconsin Vegetable and Fruit Crops [1]

Crop	Boron	Copper	Manganese	Zinc
Apple	Medium	Medium		Medium
Asparagus	Medium	Low	Low	Low
Bean, dry (kidney, navy)	Low	Low	High	Medium
Bean, lima	Low	Low	High	Medium
Beet, table	High	High	Medium	Medium
Broccoli	Medium	Medium	Medium	
Brussel sprouts	Medium	Medium	Medium	
Cabbage	Medium	Medium	Medium	Low
Carrot	Medium	Medium	Medium	Low
Cauliflower	High	Medium	Medium	
Celery	High	Medium	Medium	
Cucumber	Low	Medium	Medium	Medium
Lettuce	Medium	High	High	Medium
Lupine	Low	Low	Low	Medium
Onion	Low	High	High	High
Pea, canning	Low	Low	Medium	Low
Potato	Low	Low	Medium	Medium
Spinach	Medium	High	High	High
Tomato	High	High	Medium	Medium

[1] Source: "Nutrient Application Guidelines for Field, Vegetable and Fruit Crops in Wisconsin", UW-Madison Publication A2809, 2006

Wisconsin Codes and Descriptions of Soil Test Interpretation Categories [1]

Category			Probability of Yield Increases (%) [a]
Name	Symbol	Description	
Very Low	VL	> Substantial quantities of nutrients required to optimize crop yield. > Buildup should occur over 5 TO 8 year period. > Response to secondary or micronutrients more likely for high or medium demanding crops, respectively.	> 90
Low	L	> Somewhat more nutrients than those removed by crop harvest are required. > Response to secondary or micronutrients most likely for high demanding crops, but unlikely for medium or low demanding crops.	60 - 90
Optimum	O	> Most desirable soil test category, both economically and environmentally. > Nutrient additions approximately equal to amounts removed by harvested portion of crop. > Response to secondary and micronutrients is unlikely.	30 - 60
High	H	> Some nutrients are required, and returns are optimized at rates equal to about 1/2 of nutrient removed by crop.	5 - 30
Very High	VH	> Used only for potassium. > Soil tests are above the optimum range and gradual draw-down is recommended. > Approximately 1/4 of nutrients removed is recommended.	approximately 5
Excessively High	EH	> No fertilizer is recommended for most soils. > On medium and fine textured soils, a small amount of starter fertilizer is advised for row crops.	< 2

[a] Percentage of fields that can be expected to show a profitable yield increase when recommended nutrients are applied.

[1] Source: "Optimum Soil Test Levels for Wisconsin", UW-Madison Publication A3030, 1999

Wisconsin Soil Test Value Interpretation Values for Secondary and Micronutrients [1]

		Soil Test Category				
		← Soil Test Value [in parts per million (ppm)] →				
Nutrient	Soil Texture Code [a]	Very Low (VL)	Low (L)	Optimum (O)	High (H)	Excessively High (EH)
Calcium	1	0 - 200	201 - 400	401 - 600	> 600	
	2,3,4	0 - 300	301 - 600	601 - 1000	> 1000	
Magnesium	1	0 - 25	26 - 500	51 - 250	> 250	
	2,3,4	0 - 50	21 - 100	101 - 500	> 500	
Boron	1	0.0 - 0.2	0.3 - 0.4	0.5 - 1.0	1.1 - 2.5	> 2.5
	2,4	0.0 - 0.3	0.4 - 0.8	0.9 - 1.5	1.6 - 3.0	> 3.0
	3	0.0 - 0.5	0.6 - 1.0	1.1 - 2.0	2.1 - 4.0	> 4.0
Zinc	1,2,3,4	0.0 - 1.5	1.6 - 3.0	3.1 - 20.0	21.0 - 40.0	> 40.0
Manganese [b]	1,2,3,4		0 - 10	11 - 20	> 20	
	1,2,3,4		> 6.9 pH	6.0 - 6.9 pH	< 6.0 pH	

[a] **Soil Texture Codes: 1** = Sandy, **2** = Loams, Silts and Clays, **3** = Organic, **4** = Red

[b] For manganese, soil test levels are only used when organic matter content is less than or equal to 6%. Above 6%, use soil pH for determining Manganese requirements.

[1] Source: "Optimum Soil Test Levels for Wisconsin", UW-Madison Publication A3030, 1999

Wisconsin Boron Recommendations [1]

		Boron Soil Test Level [a]				Boron Soil Test Level [a]			
		Very Low	← lbs./acre of elemental Boron → Crop Boron Demand			Low	← lbs./acre of elemental Boron → Crop Boron Demand		
Soil Texture	Nutrient	ppm	Low	Medium	High	ppm	Low	Medium	High
Sands, Loamy Sands	Elemental Boron Recommendation	< 0.2	[b] see below	2 lbs./a	3 lbs./a	0.3 - 0.4	none	1 lbs./a	2 lbs./a
	Feast 10% Complex Boron	< 0.2		1.8 gals./a	2.0 gals./a	0.3 - 0.4		0.9 gals./a	1.8 gals./a
Sandy Loams, Loams, Silt Loams, Silts, Clays	Elemental Boron Recommendation	< 0.3		2 lbs./a	3 lbs./a	0.4 - 0.8		1 lbs./a	2 lbs./a
	Feast 10% Complex Boron	< 0.3		1.8 gals./a	2.0 gals./a	0.4 - 0.8		0.9 gals./a	1.8 gals./a
Mucks, Peats	Elemental Boron Recommendation	< 0.5		2 lbs./a	3 lbs./a	0.6 - 1.0		1 lbs./a	2 lbs./a
	Feast 10% Complex Boron	< 0.5		1.8 gals./a	2.0 gals./a	0.6 - 1.0		0.9 gals./a	1.8 gals./a

[a] **DO NOT apply boron unless a soil or plant analysis verifies deficiency.**

[b] **Never apply Boron in the row, in contact with the seed, due to germination toxicity. Proper placement is to side of row (4x4).**

Feast 10% Complex B: Maximum **soil** application rate is 2 gallon per acre (2.24 lbs/acre)
Maximum **foliar** application rate is 0.5 gallon per acre (0.56 lbs/acre)

Boron dediciency may occur: (1) on sandy soils which are less likely to hold boron, **(2)** on soils low in organic matter, **(3)** on soils with a pH of 7.0, or above, **(4)** and more widespread than deficiencies of any other micronutrient, **(5)** and lack of boron often limits productiond of forage legumes (alfalfa, clover, trefoil) and some vegetable crops..

[1] Source: "Understanding Plant Nutrients - Soil and Applied Boron", UW-Madison Publication A2522, 1999

Boron Plant Analysis Interpretations for Common Wisconsin Crops [1]

			INTERPRETATION (ppm B)			
Crop	**Plant Part Sampled**	**Time of Sampling**	**Deficient**	**Low**	**Sufficient**	**High**
Alfalfa	Top 6 inches	Bud	< 20	20 - 30	30.1 - 80	> 80
Corn	Whole Plant	6 - 16 Inches	< 4	4.0 - 6.4	6.5 - 40	40.1 - 55
Corn	Earleaf	Tassel to Silking	< 2	2 - 5	5.1 - 40	40.1 - 55
Oat	Top Leaves	Boot Stage	na	< 3	3 - 40	40.1 - 55
Soybean	First Trifolate	Early Flower	na	< 20	20 - 50	50.1 - 80

DO NOT apply boron unless plant analysis has verified deficiency. If confirmed, foliar apply **Feast 10% B Complex** at a maximum of 0.50 gal./a (2 qt./a) to achieve the efficiency equivalent of 2.8 lbs. boron nutrient. Refer to Wisconsin Boron Recommendation chart.

Boron deficiency: (1) because boron is immobile in plants, deficiency appears on the youngest tissue, **(2)** this nutrient is involved in cell division, pollination and cell-wall synthesis in plants so when deficient, the growing points stop developing and will eventually die, **(3)** deficiency most likely to occur on sandy soils which are low in organic matter and have a soil pH of 7.0 or above.

[1] Source: "Understanding Plant Nutrients - Soil and Applied Boron", UW-Madison Publication A2522, 1999

Wisconsin Calcium Recommendations [1, 2]

					Soil Test Category (Soil Test Value [in parts per million (ppm)])				
Crops	**Soil Texture Code [a]**	**Nutrient**	**Soil or Foliar Applied**	**Lime Recs**	Very Low **(VL)**	Low **(L)**	Optimum **(O)**	High **(H)**	Excessive High **(EH)**
					0 - 200	201 - 400	401 - 600	> 600	
Root/Tuber Vegetables (potatoes, etc) **Pome Fruit** (apple, etc)	1	Elemental Calcium Recommendations		With	100 lbs./a.	50 lbs./a.	None →		
				Without	200 lbs./a.	100 lbs./a.	None →		
Root/Tuber Vegetables (potatoes, etc) **Pome Fruit** (apple, etc)	1	**Feast 3% Ca EDTA Chelate**	**Soil** [b]	→	0.5 gal./a (4 pt./a)	→	None →		
			Foliar [c]	→	0.25 gal./a (2 pt./a)	→	None →		
					0 - 300	301 - 600	601 - 1000	> 1000	
Root/Tuber Vegetables (potatoes, etc) **Pome Fruit** (apple, etc)	2	Elemental Calcium Recommendations		With	100 lbs./a.	50 lbs./a.	None →		
				Without	200 lbs./a.	100 lbs./a.	None →		
Root/Tuber Vegetables (potatoes, etc) **Pome Fruit** (apple, etc)	2	**Feast 3% Ca EDTA Chelate**	**Soil** [b]	→	0.5 gal./a (4 pt./a)	→	None →		
			Foliar [c]	→	0.25 gal./a (2 pt./a)	→	None →		
					0 - 300	301 - 600	601 - 1000	> 1000	
Root/Tuber Vegetables (potatoes, etc) **Pome Fruit** (apple, etc)	3, 4	Elemental Calcium Recommendations		With	100 lbs./a.	50 lbs./a.	None →		
				Without	200 lbs./a.	100 lbs./a.	None →		
Root/Tuber Vegetables (potatoes, etc) **Pome Fruit** (apple, etc)	3, 4	**Feast 3% Ca EDTA Chelate**	**Soil** [b]	→	0.5 gal./a (4 pt./a)	→	None →		
			Foliar [c]	→	0.25 gal./a (2 pt./a)	→	None →		

DO NOT apply calcium unless soil or plant analysis confirms deficiency.

Exception: If soil testing shows optimum or greater calcium levels, response is unlikely. **However**, with **root/tuber** crops such as potatoes, if there is no lime recommendation, add 200 lbs. calcium per acre when test level is very low (**VL**) and 100 lbs. calcium per acre when value is low **(L)**. When there is a lime recommendation, apply 100 lbs. calcium per acre when the value is very low (**VL**) and 50 lbs. calcium per acre when value is **(L)**.

Feast 3% Ca EDTA Chelate: [b] Maximum **soil** application rate is 0.5 gallon per acre (4.9 lbs/acre).
[c] Maximum **foliar** application rate is 0.25 gallon per acre (2.45 lbs./acre).

Calcium deficiency most likely to occur: **(1)** at soil pH levels of 5 or below and low organic matter, **(2)** sandy soils where there have been repeated high potassium additions.

[a] **Soil Texture Codes: 1** = Sandy, **2** = Loams, Silts and Clays, **3** = Organic, **4** = Red

[1] Source: "Optimum Soil Test Levels for Wisconsin", UW-Madison Publication A3030, 1999

[2] Source: "Understanding Plant Nutrients - Soil and Applied Calcium", UW-Madison Publication A2523, 2004

Calcium Plant Analysis Interpretations for Common Wisconsin Crops [1]

			INTERPRETATION			
			← Percent (%) Ca →			
Crop	**Plant Part Sampled**	**Time of Sampling**	**Deficient**	**Low**	**Sufficient**	**High**
Alfalfa	Top 6 inches	Bud	< 0.50	0.50 - 1.10	1.11 - 2.00	> 2.00
Corn	Earleaf	Silking	< 0.10	0.10 - 0.30	0.31 - 0.60	> 0.60
Oat	Top Leaves	Boot Stage	< 0.10	0.10 - 0.20	0.21 - 0.50	> 0.50
Soybean	First Trifolate	Early Flower	< 0.50	0.50 - 1.10	1.10 - 2.00	> 2.00

DO NOT apply calcium unless plant analysis has verified deficiency. If confirmed, foliar apply **Feast 3% Ca Chelate** at a maximum of 0.25 gal./a (2 pt./a) to achieve the efficiency equivalent of 24.5 lbs. calcium nutrient. Refer to Wisconsin Calcium Recommenmdation chart.

Calcium deficiency symptoms include: (1) failure of terminal buds and roots to develop (2) and show up first at the growing points because calcium is immobile in plants (3) calcium deficiency symptoms in corn - new leaf tips stick together and prevent the normal emergence and unfolding of leaves, a condition known as "buggy whipping".

[1] Source: "Understanding Plant Nutrients - Soil and Applied Calcium", UW-Madison Publication A2523, 2004

Wisconsin Copper Recommendations [1]

		Sand		Loams, Silts, Clays		Organic	
		← lbs./acre of elemental Copper →					
Crop	**Nutrient [a]**	Band [b]	Broadcast	Band [b]	Broadcast	Band [b]	Broadcast
Lettuce, onion, spinach, tomato	Elemental Copper Recommendation	2	10	3	12	4	13
	Cu Chelate Recommendation	0.34 lb.	1.7 lb.	0.51 lb.	2.00 lb.	0.68 lb.	2.21 lb.
	Feast 7.5% Cu EDTA Chelate	0.43 gal. or 3.4 pt.	0.5 gal. or 4 pt.	→	→	→	→
Alfalfa, barley, canola, carrot, cauliflower, celery, clover, corn, oats, radish, sudan-grass, wheat	Elemental Copper Recommendation	1	4	2	8	3	12
	Cu Chelate Recommendation	0.17 lb.	0.68 lb.	0.34 lb.	1.36 lb.	0.51 lb.	2.00 lb.
	Feast 7.5% Cu EDTA Chelate	0.21 gal. or 1.7 pt.	0.5 gal. or 4 pt.	0.43 gal. or 3.4 pt.	0.5 gal. or 4 pt.	→	→
Asparagus, beans, broccoli, cabbage, cucumber, mint, pea, potato, rye, soybean	Elemental Copper Recommendation	0	0	0	0	2	0
	Cu Chelate Recommendation	0	0	0	0	0.34 lb.	0
	Feast 7.5% Cu EDTA Chelate	0	0	0	0	0.43 gal. or 3.4 pt.	0

DO NOT apply copper unless soil or plant analysis has verified deficiency.

Feast 7.5% Cu EDTA Chelate: Maximum **soil** application rate is 0.5 gallon per acre (0.4 lbs./acre)
Maximum **foliar** application rate is 0.25 gallon per acre (0.2 lbs./acre)

Copper deficiency most likely to occur: **(1)** on very acid soils, particularly mucks, **(2)** as organic matter content increases, **(3)** as soil pH increases, certainly at or above 7.5.

[a] Above **Feast 7.5% Cu EDTA Chelate and** Copper chelate rates are at 1/6 of elemental Copper rate for each soil category, in both band and broadcast application.

[b] Recommended soil application method, where soil test results for Cation Exchange Capacity and Organic Matter values are high enough, is In-Row (0x0).

[1] Source: "Understanding Plant Nutrients - Soil and Applied Copper", UW-Madison Publication A2527, 2004

Copper Plant Analysis Interpretations for Common Wisconsin Crops [1]

			INTERPRETATION			
			← ppm Cu →			
Crop	**Plant Part Sampled**	**Time of Sampling**	**Deficient**	**Low**	**Sufficient**	**High**
Alfalfa	Top 6 inches	Bud	< 3.0	3.0 - 7.0	7.1 - 30.0	30.1 - 50.0
Corn	Earleaf	Silking	< 2.0	2.0 - 5.0	5.1 - 20.0	20.1 - 50.0
Oat, Wheat	Top Leaves	Boot Stage	< 3.0	3.0 - 5.0	5.1 - 20.0	20.1 - 50.0
Potato	Top Leaves	Flowering	< 2.0	2.0 - 5.0	5.1 - 30.0	30.1 - 50.0
Soybean	First Trifolate	Early Flower	< 5.0	5.0 - 9.0	9.1 - 30.0	30.1 - 50.0

DO NOT apply copper unless plant analysis has verified deficiency. If confirmed, foliar apply **Feast 7.5% Cu Chelate** at a maximum of 0.25 gal./a (2 pt./a) to achieve the equvalent of 2.0 lbs. copper nutrient. Refer to Wisconsin Copper Recommendation chart.

Copper deficiency most likely: (1) where organic matter content is high, so organic soils are more likely to be deficient in copper than mineral soils, **(2)** on acid, organic soils, particularly mucks, **(3)** soils with a pH above 7.5, **(4)** plant symptoms include reduced plant vigor, plant lodging/stanability problems, older leaf tips become brown with dead tissue; and, younger leaves do not unroll, the growing point may die **(5)** and toxic levels of copper reduces seed germination, shoot vigor and iron availability.

[1] Source: "Understanding Plant Nutrients - Soil and Applied Copper", UW-Madison Publication A2527, 2004

Wisconsin Iron Recommendations [1]

Nutrient	Soil Application [a] Elemental Iron Lbs./A.	Foliar Application Elemental Iron Lbs./A.
Fe Chelate Recommendations	0.5 - 2 lbs./a	0.10 - 0.15 lbs./a.
Feast 4.5% Fe HEDTA Chelate	**0.25 gal./a** (2 pt./a.)	**0.125 gal./a** (1 pt./a)

DO NOT apply iron unless soil or plant analysis has verified deficiency.

Feast 4.5% Fe HEDTA Chelate: Maximum **soil** application rate is 0.25 gallon per acre (0.13 lbs./acre).
Maximum **foliar** application rate is 0.125 gallon per acre (0.07 lbs./acre).

Iron deficiency may occur: (1) in soils with a pH between 7.4 and 8.5 (alkaline soils), **(2)** low organic matter soils, **(3)** on calcareous soils, **(4)** when early season soil conditions are cool and wet.

Crops **tolerant of low Iron availability** includes alfalfa, corn and small grains.
Crops **sensitive of low Iron availability** includes most fruits and some ornamentals.

[a] Recommended soil application method, where soil test results for Cation Exchange Capacity and Organic Matter values are high enough, is In-Row (0x0).

[1] Source: "Understanding Plant Nutrients - Soil and Applied Iron", UW-Madison Publication A3554, 2004

Iron Plant Analysis Interpretations for Common Wisconsin Crops [1]

			I N T E R P R E T A T I O N (ppm Fe)			
Crop	Plant Part Sampled	Time of Sampling	Deficient	Low	Sufficient	High
Alfalfa	Top 6 inches	Bud	< 20	20 - 30	31 - 250	> 250
Corn	Earleaf	Silking	< 10	10 - 50	51 - 250	> 250
Oat, Wheat	Top Leaves	Boot Stage	na	< 20	20 - 250	> 250
Potato	Top Leaves	Flowering	na	< 11	11 - 300	> 300
Soybean	First Trifolate	Early Flower	< 30	30 - 50	51 - 350	> 350

DO NOT apply iron unless plant analysis has verified deficiency. If confirmed, foliar apply **Feast 4.5% Fe Chelate** at a maximum of 0.125 gal./a (1 pt./a) to achieve the efficiency equivalent of 0.7 lbs. iron nutrient. Refer to Wisconsin Iron Recommendation chart.

Iron deficiency most likely: (1) as soil pH increases, with a minimum around 7.4-8.5 pH, **(2)** in cool, wet soils early in the growing season, (3) alkaline soils where microbial respiration (produce carbon dioxide) which reacts with soil water to form bicarbonate ions which will immobilize iron within the plants causing deficiency, **(4)** because iron is immobile in plants, dfficiency symptoms appear first on the youngest leaves, causing yellowing or chlorosis, (5) if deficiency is severe and prolonged, each new leaf emerges lighter in color than preceding leaf.

[1] Source: "Understanding Plant Nutrients - Soil and Applied Iron", UW-Madison Publication A3554, 2004

Wisconsin Magnesium Recommendations [1]

Nutrient	Soil Application [a] 10 - 20 lbs Elemental Mg/acre [b]	Foliar Application 2 - 4 lbs Elemental Mg/acre [b]
Mg Chelate Recommendation	0.5 to 0.8 lb Mg/a	0.10 to 0.15 lb Mg/a
Feast 2.5% Mg EDTA Chelate	**0.5 gal./a** (4 pt./a.)	**0.25 gal./a** (2 pt./a.)

DO NOT apply magnesium unless soil or plant analysis has verified deficiency.

Feast 2.5% Mg EDTA Chelate: Maximum **soil** application rate is 0.5 gallon per acre (0.13 lbs./acre).
Maximum **foliar** application rate is 0.25 gallon per acre (0.07 lbs./acre).

Low soil levels of magnesium can be found: (1) when applied liming materials are low in magnesium, **(2)** soil texture is sandy to sandy loam, with very acidic pH, **(3)** calcareous organic soils, **(4)** magnesium soil test levels less than optimum and soil potassium levels are above optimum.

[a] Recommended soil application method, where soil test results for Cation Eechange Capacity and Organic Matter values are high enough, is In-Row (0x0).

[b] It is recommended to add magnesium when soil test shows low to very low levels; and, when recommended, a row placement of 10 to 20 lbs. of elemental magnesium can be applied. Foliar rates are at 1/5 the soil rates for elemental magnesium.

[1] Source: "Understanding Plant Nutrients - Soil and Applied Magnesium", UW-Madison Publication A2524, 2004

Magnesium Plant Analysis Interpretations for Common Wisconsin Crops [1]

			INTERPRETATION			
			← Percent (%) Mg →			
Crop	**Plant Part Sampled**	**Time of Sampling**	**Deficient**	**Low**	**Sufficient**	**High**
Alfalfa	Top 6 inches	Bud	< 0.20	0.20 - 0.30	0.31 - 1.00	> 1.00
Corn	Earleaf	Silking	< 0.10	0.10 - 0.20	0.21 - 0.40	> 0.40
Oat	Top Leaves	Boot Stage	< 0.10	0.10 - 0.15	0.16 - 0.30	> 0.30
Soybean	First Trifolate	Early Flower	< 0.15	0.15 - 0.30	0.31 - 1.50	> 1.50

DO NOT apply magenesium unless plant analysis has verified deficiency. If confirmed, foliar apply **Feast 2.5% Mg Chelate** at a maximum of 0.25 gal./a (2 pt./a) to achieve the efficiency equivalent of 0.7 lbs. magnesium nutrient. Refer to Wisconsin Magnesium Recommendation chart.

Magnesium deficiency most likely: (1) on acid soils, especially sands, **(2)** calcareous soils, **(3)** high soil test levels of potassium, **(4)** sandy soils where high rates of potassium or ammonium fertilizer have been applied, **(5)** deficiency symptoms include yellowing (chlorosis) or (interveinal chlorosis) of plant leaves first appearing on lower leaves.

[1] Source: "Understanding Plant Nutrients - Soil and Applied Magnesium", UW-Madison Publication A2524, 2004

Wisconsin Manganese Recommendations [1]

(when soil test level is low, and crop demand is medium to high)

		Soil Application [a]	**Foliar Application**
Crop	**Nutrient**	← lbs./acre of elemental Manganese →	
Beans (dry, lima, snap), lettuce, oats, onion, radish, raspberry, soybean, spinach, sorghum-sudan, wheat	Mn Chelate Recommendation	0.8 lb.	0.15 lb.
	Feast 6% Mn EDTA Chelate	**0.5 gal./a.** (4 pt./a.)	**0.22 gal./a.** (1.8 pt./a)
Barley, beet, broccoli, brussels sprouts, cabbage, canola, carrot, cauliflower, celery, corn, cucumber, pea, potato, tobacco, tomato, triticale	Mn Chelate Recommendation	0.5 lb.	0.10 lb.
	Feast 6% Mn EDTA Chelate	**0.5 gal./a.** (4 pt./a.)	**0.15 gal./a.** (1.2 pt./a.)
Other crops (not listed above)	Mn Chelate Recommendation	0	0
	Feast 6% Mn EDTA Chelate	0	0

DO NOT apply manganese unless soil or plant analysis has verified deficiency.

Maximum rates of Manganese chelates for foliar application when soil test results show low and crop grown demand is medium is 0.15 lbs./acre. When crop grown demand is high, the maximum amount is 0.20 lbs./acre.

Feast 6% Mn EDTA Chelate: Maxiumum **soil** application rate is 0.5 gallon per acre (0.33 lbs./acre).
Maxiumum **foliar** application rate is 0.22 gallon per acre (0.145 lbs./acre).

Manganese deficiency may occur: (1) on neutral or calcareous mineral soils, **(2)** on calcareous muck and organic soils that have been burned, **(3)** when soil organic matter is more than 6% and/or soil pH is above 6.5, **(4)** prolonged wet soil conditions, such as in a marsh.
As a general rule: Manganese is low if soil pH is > 6.9, optimum is soil pH if between 6.0 and 6.9, and high if soil pH is < 6.0.

[a] Recommended soil application method, where soil test results for Cation Exchange Capacity and Organic values are high enough, is In-Row (0x0).

[1] Source: "Understanding Plant Nutrients - Soil and Applied Manganese", UW-Madison Publication A2526, 2004

Manganese Plant Analysis Interpretations for Common Wisconsin Crops [1]

			INTERPRETATION			
			← ppm Mn →			
Crop	**Plant Part Sampled**	**Time of Sampling**	**Deficient**	**Low**	**Sufficient**	**High**
Alfalfa	Top 6 inches	Bud	< 15	15 - 25	26 - 150	151 - 300
Corn	Earleaf	Silking	< 15	15 - 25	26 - 150	151 - 200
Oat, Wheat	Top Leaves	Boot Stage	< 10	10 - 25	26 - 150	151 - 250
Onion	Tops	Midseason	< 10	10 - 20	21 - 150	151 - 300
Potato	Top Leaves	Flowering	< 10	10 - 20	21 - 200	201 - 400
Soybean	First Trifolate	Early Flower	< 15	15 - 20	21 - 100	101 - 250

DO NOT apply manganese unless plant analysis has verified deficiency. If confirmed, foliar apply **Feast 6% Mn Chelate** at a maximum of 0.22 gal./a (1.8 pt./a) to achieve the efficiency equivalent of 1.45 lbs. manganese nutrient. Refer to Wisconsin Manganese Recommendation chart.

Manganese deficiency may occur: (1) on soils with a pH above 6.5, **(2)** manganese toxicity (too much manganese) is common in acid soils below pH of 5.5, **(3)** soils high in organic matter (more than 6%) and near neutral in pH (above pH of 6.5), **(4)** prolonged wet soil conditions and poor soil aeration, (5) on neutral to high pH soils that are also high in organic matter, **(6)** deficiency symptoms on leaves ranges from grey spots to yellow parallel streaks to interveinal yellow chlorosis.

[1] Source: "Understanding Plant Nutrients - Soil and Applied Manganese", UW-Madison Publication A2526, 2004

Wisconsin Zinc Recommendations [1]

	Soil Application [a]		Foliar Application
	← lbs./acre of elemental Zinc →		
Nutrient	Band	Broadcast	
Zn Chelate Recommendations	0.5 - 1 lb./a	1 - 2 lbs./a	0.15 lb./a.
Feast 9% Zn EDTA Chelate	**0.5 gal./a.** (4 pt./a.) →		**0.15 gal./a** (1.2 pt./a.)

DO NOT apply zinc unless soil or plant analysis has verified deficiency.

Feast 9% Zn EDTA Chelate: Maximum **soil** application rate 0.5 gallon per acre (0.5 lbs./acre).
Maximum **foliar** application rate is 0.15 gallon per acre (0.15 lbs./acre).

Zinc deficiency may occur: (1) on scalped or severely eroded soils, **(2)** in sands, sandy loams and organic soil types, **(3)** in soils that exhibit severe soil compaction, **(4)** when soil pH is above 6.5, **(5)** when soil test results indicate a high level of available Phosphorus, **(6)** during cool, wet weather conditions usually early in the growing season.

[a] Recommended soil application method, where soil test results for Cation Exchange Capacity and Organic Matter values are high enough, is In-Row (0x0).

[1] Source: "Understanding Plant Nutrients - Soil and Applied Zinc", UW-Madison Publication A2528, 2004

Zinc Plant Analysis Interpretations for Common Wisconsin Crops [1]

			I N T E R P R E T A T I O N			
			← ppm (Zn) →			
Crop	**Plant Part Sampled**	**Time of Sampling**	**Deficient**	**Low**	**Sufficient**	**High**
Alfalfa	Top 6 inches	Bud	< 10	10 - 20	21 - 70	71 - 100
Corn	Earleaf	Silking	< 15	15 - 25	26 - 75	76 - 150
Oat	Top Leaves	Boot Stage	< 5	5 - 20	21 - 70	71- 100
Soybean & Snap Bean	First Trifolate	Early Flower	< 15	15 - 20	21 - 50	51 - 75

DO NOT apply zinc unless plant analysis has verified deficiency. If confirmed, foliar apply **Feast 9.0% Zn Chelate** at a maximum of 0.15 gal./a (1.2 pt./a) to achieve the efficiency equivalent of 1.50 lbs. zinc nutrient. Refer to Wisconsin Zinc Recommendation chart.

Zinc deficiency may occur: (1) scalped or severely eroded soils, **(2)** sands, sandy loams and organic soils, **(3)** where soil has severe compaction, (4) where soil pH is above 6.5, **(5)** high levels of available soil phosphorus, **(6)** cool, wet ewather early in growing season, **(7)** deficiency appears on younger leaves as bleached tissue on either side of leaf midrib; or, as shortened internodes (rosetting) or decreased leaf size (little leaf) on broadleaf plants.

[1] Source: "Understanding Plant Nutrients - Soil and Applied Zinc", UW-Madison Publication A2528, 2004