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Sohar Sulphur Fertilizers LLC

Sulphur Importance in Crops' Production

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Sulphur in Crop Production

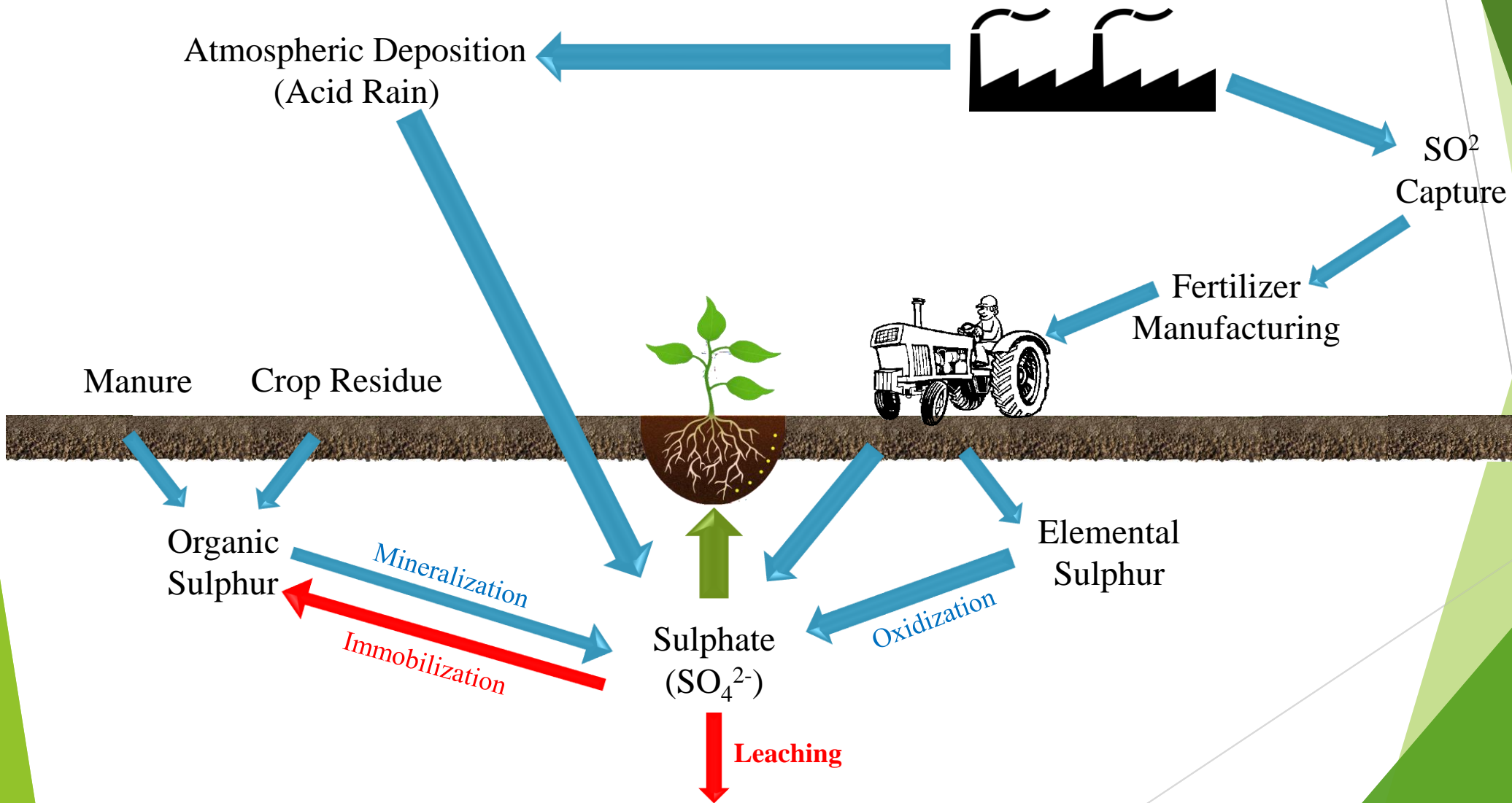
What role does Sulphur play in the crop and soil?

- Incorporated into essential amino acids, proteins, oils and organic compounds.
- Critical in the early establishment of crops
- Root nodulation and nitrogen fixation in legumes
- Sulphur contributes to resistance of environmental stresses
- Deficiency results in stunted early growth - associated yield losses
- Sulphur is key to the flavor of onions!



Sulphur deficiency in Canola (Rapeseed)
Image: CanolaWatch.org

Sulphur in Crop Production

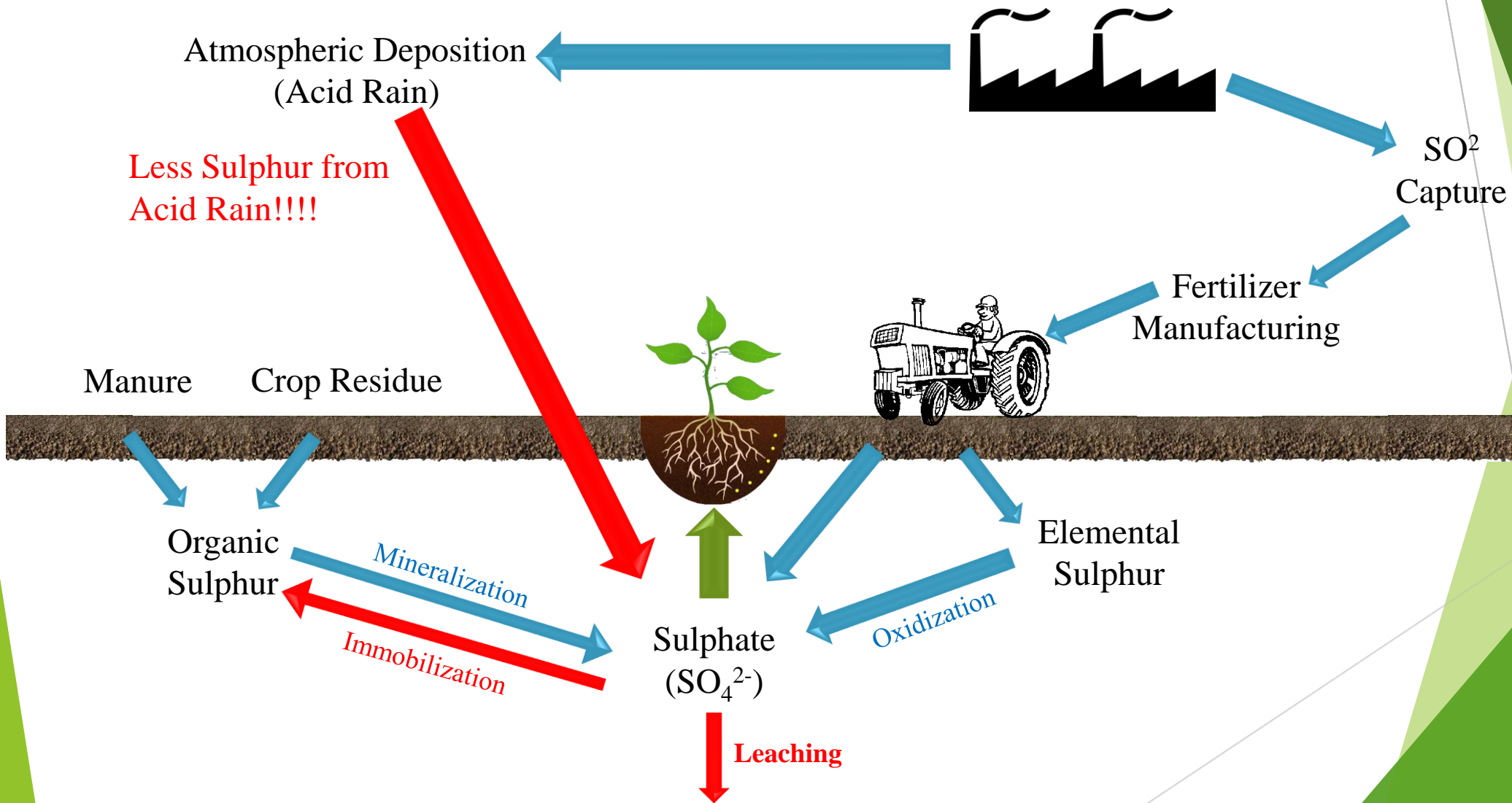


Why Sulphur is important Now?

Why is Sulphur suddenly ‘the 4th nutrient’?

- Sulphur deficiency in cropping systems has not traditionally been a problem... But this is changing
 - Lower Sulphur emissions (environmental regulations)
 - More high analysis fertilizers (less S containing fertilizers)
 - Greater cropping intensity (higher yields)

Why Sulphur is important Now?



Why Sulphur is important Now?

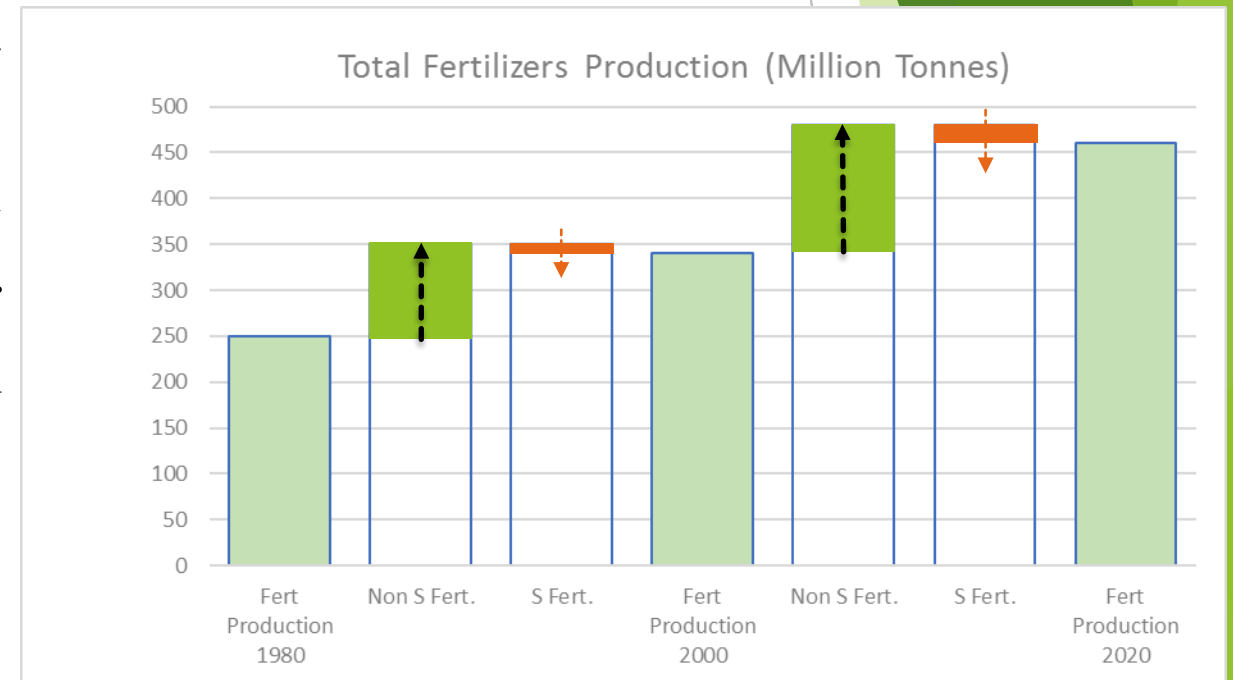
More 'high analysis' fertilizer

- Supply of urea, DAP, MAP, MOP have all increased sharply.
- These have taken over from low analysis fertilizers like single super phosphate (SSP) and Ammonium Sulphate (AS)
- Less Sulphur is being added to soils through fertilizer

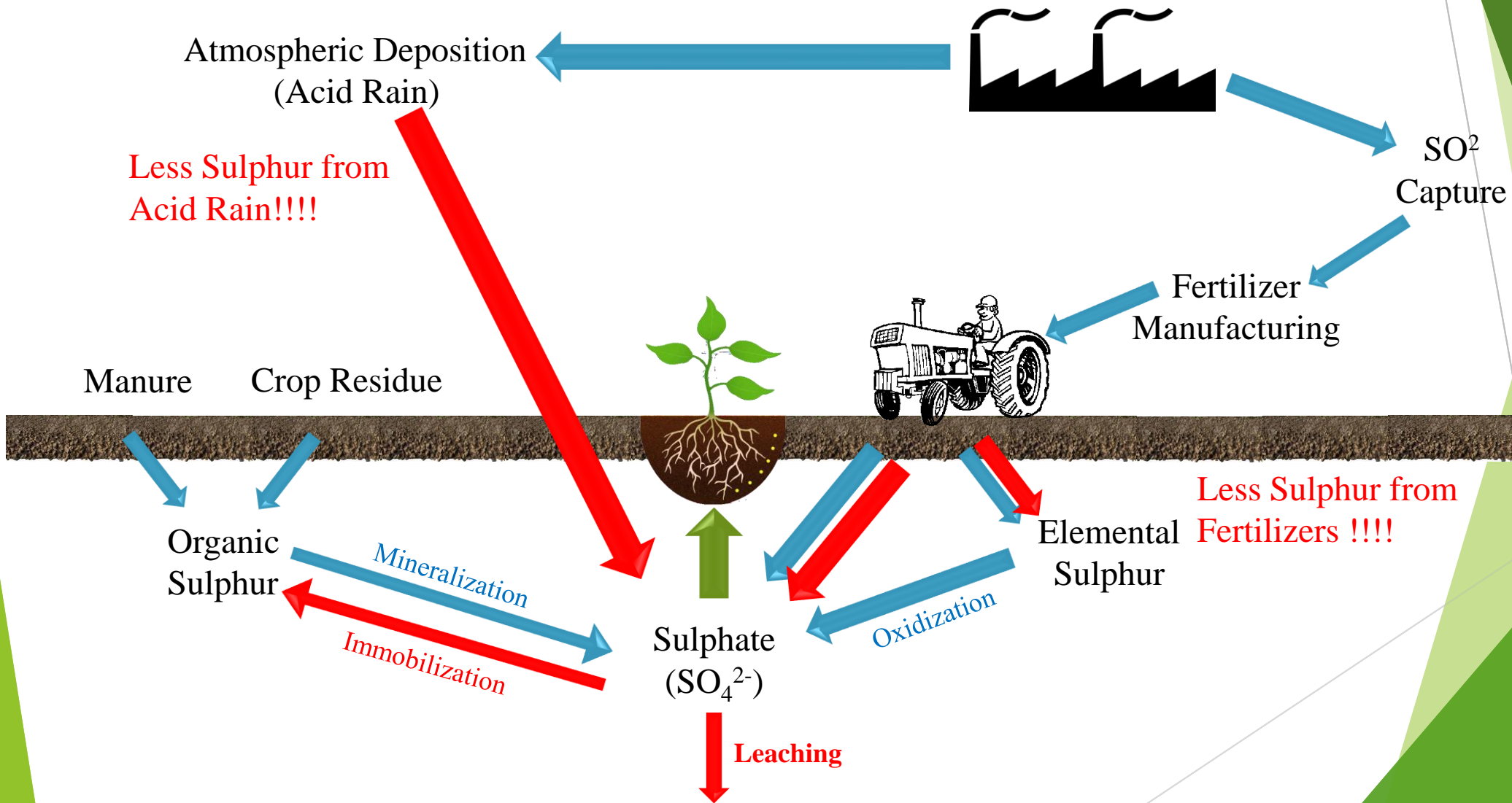
Data: CRU, IFA

Non-S Fert contains <2% S. incl.; urea, AN, CAN, DAP, MAP, TSP, MOP, NPK

S Fert incl.; AS, SSP, SOP



Why Sulphur is important Now?



Sulphur Fertilizers

Sulphur, the “Yield+ Quality nutrient” improves crop quality in many ways:

- Increasing the oil content of seeds.
- Increasing protein percentage in plants and harvested produce.
- Improving nutritional quality of forages by providing a balanced N:S ratio.
- Improving starch content of tubers.
- Improving baking quality of Wheat.
- Increasing sugar recovery in Sugarcane.
- Enhancing marketability of Copra (Coconut kernel).
- Increasing the Sulphahydril Acetyl in Onion & Garlic.

Sulphur Fertilizers

Role of Sulphur:

- Helps in synthesis of chlorophyll.
- Helps in increasing root nodules on the legume crop and helps in Nitrogen fixation from atmosphere.
- Helps in synthesis of amino acids like Cysteine, Cystine and Methionine.
- Increases oil percentage in oilseed & Pungency in Onion, garlic & Keeping quality of vegetable.
- Helps in reclamation of saline and alkaline soils and reduces soil pH. 3 kg calcium carbonate is neutralized by 1 kg of Sulphur. Thus Sulphur can be used as soil conditioner, thereby improves soil physical / chemical and biological properties.
- Enhances availability of Phosphorus, Iron, & Zinc.
- Increases cane height, girth and sugar content, malleable cane, juice quality, sugar recovery and yield.

Sulphur Fertilizers

Current Sulphur fertilizers

- Gypsum –By-product
- Kieserite –Magnesium and Sulphur
- Ammonium Sulphate–By-product
- Ammonium Thiosulphate–Only used in North America fertigation systems
- SSP –On the way out
- Potassium Sulphate (SOP) –Attracting huge interest
- Polysulphate (Polyhalite) –New product from North England

Sulphur Fertilizers

Sulphur enhanced fertilizers

- Fertilizer industry has recognized the need for Sulphur
- Sulphur also has a value... Premium fertilizer products
- Incorporation of Sulphate and elemental Sulphur
- Products more expensive
- NP+S is developing quickly in the US, Brazil and Africa
- Sulphur needs to come in a package

	N%	P%	K%	S%
S-Bentonite	0	0	0	90
S-coated-urea	40	0	0	10
S-coated-MAP	10	44	0	12
S-coated-TSP	0	40	0	15
Fortified SSP	0	6	0	45
NP+S	12-20	20-48	0	5-15
NK+S	18-28	0	12-18	5-10
NPK+S	10-20	15-25	10-18	5-10

Sulphur Bentonite Fertilizer

Advantages of Sulphur fertilizers



- Highest Sulphur Content among all fertilisers 90%
- Low production cost, low cost sulphur nutrient with high volume
- High Value Sulphur Fertilizer
 - I. Sulphur nutrient: provides a season long release of Sulphate.
 - II. Soil Amendment: 1 kg produces 3 kg Sulphuric acid (H^2SO_4). Improves Phosphate & Micronutrients availability in Calcareous Soils.
 - III. Efficient carrier for Micronutrients and other nutrients

Sulphur Bentonite Fertilizer

Sulphur uptake – Kg Sulphur require for 1,000 kg yield

Crops	Kg Sulphur require
Oil Seed	5 – 20 kg
Pulses	5 – 13 kg
Cereals	1 – 6 kg
Onion / Garlic	5 – 20 kg
Sugarcane	5 – 20 kg

Sulphur uptake is generally 9-15% of N uptake and comparable to P uptake

Sulphur Bentonite Fertilizer

Percentage Yield Increase

Crops	% Yield Increase
Oil Seed/ Cotton	30-32
Cereals	25
Sugarcane	22
Ground nut	32
Mustad	30
Wheat	25
Soybean	25
Pigeon pea	22
Green gram	20
Sunflower	20
Rice	17
Linseed	16

Sulphur Bentonite Fertilizer

Effect of Sulphur application through elemental 'S' on crop yield

Crops	Average yield, Kg/acre		% increase
	Without S	With S	
Groundnut	938	1,587	69
Mustard	1,782	2,596	46
Green gram	443	868	96
Pea	932	1,816	95
Rice	2,023	5,135	154
Wheat	2,790	3,810	37
Sugarcane	73,150	87,550	20
Cotton	2,346	3,144	34
Soybean	1,390	1,910	37
Tomato	50,000	62,500	25
Onion	20,000	26,000	30
Banana	22,000	26,800	22
Potato	20,000	25,000	25

The application of 200-250 kg S/acre (100 mesh fineness) have been found to be optimum. As it is slow acting, one application is sufficient for 2-3 years

Sulphur Bentonite Fertilizer

Sulphur Requirement of Crops

Crops	Kg S-acre
Oil Seed/Cotton	20-50
Cereals	24-40
Sugarcane	30-60
Legumes	25-50
Vegetables	25-60

Sulphur Bentonite Fertilizer

Direct & residual effects of various Sulphur (S) sources on crop yield

Source of Sulphur	Cropping System (Yield kg/acre)			
	Groundnut	% increase over control	Wheat	% increase over control
Gypsum	1,112	12	2,179	9
Pyrites	1,142	15	2,158	8
Ammonium Sulphate	1,174	18	2,216	10
Sulphur Bentonite (Elementals)	1,217	22	2,279	14
Without S (Control)	997	0	2,007	0

Sulphur Bentonite Fertilizer

Crop	Average Yield			Crop Price \$/Qtl	Net Increase	Sulphur Req.	Profit Ratio	
	Without S	With S	Increase					
Tomato	500.00	625.00	125.00	15.38	1923.08	60	1:	46
Rice	20.23	51.35	31.12	23.08	718.15	45	1:	23
Potato	200.00	250.00	50.00	18.46	923.08	60	1:	22
Pea	9.32	18.16	8.84	76.92	680.00	50	1:	20
Soybean	13.90	19.10	5.20	49.23	256.00	20	1:	18
Cotton	23.46	31.44	7.98	64.62	515.63	45	1:	17
Banana	220.00	268.00	48.00	12.31	590.77	60	1:	14
Onion	200.00	260.00	60.00	9.23	553.85	60	1:	13
Sugarcane	731.50	875.50	144.00	3.85	553.85	60	1:	13
Groundnut	9.38	15.87	6.49	73.85	479.26	60	1:	12
Green Gram	4.43	8.68	4.25	92.31	392.31	50	1:	11
Mustard	17.82	25.96	8.14	38.46	313.08	60	1:	8
Wheat	27.90	38.10	10.20	21.54	219.69	45	1:	7
Black gram	6.25	8.90	2.65	69.23	183.46	50	1:	5

Based on 2012 Study in Indian Market

Sulphur Bentonite Fertilizer

N use efficiency as affected by S Fertilization in Winter

N use efficiency as affected by S fertilization in Winter Wheat

Treatment	N Uptake (Kg N/acre)		N Use Efficiently	
	Seed	Straw	Apparent	Real
Control	151.0	45.8	79.0	59.0
Elemental S (100 kg/ha)	179.0	47.5	91.0	71.0
% increase over controlled	19.0	4.0	15.0	20.0

N use efficiency as affected by S fertilization in Winter Oil Seeds Rape

Treatment	N Uptake (Kg N/acre)		N Use Efficiently	
	Seed	Straw	Apparent	Real
Control	159.0	18.0	88.0	48.0
Elemental S (50 kg/ha)	190.0	21.8	106.0	64.0
% increase over controlled	19.0	21.0	20.0	33.0

Oman Blend

Oman Blend is a unique formula developed and experimented in Oman via Oman Farmers Associations for 3 years.

The formula is based on Sulphur Bentonite 90% fertilizers and addition additional portion of Micronutrients such as; Copper, Boron, Zinc and manganese.

The Oman Blend can be use for seasonal crops like Tomato, Potato, chili, egg plant, etc. as well for trees like Palm tree, Mango, Limon etc.

Oman Blend

Dosage;

The use of the fertilizers depends on the soil deficiency as well salinity and crops.

As a source of Sulphur and Micronutrients: 10-15KG/Acre/Use

As Soil Enhancer: 125-250KG/Acre/Use

For trees: 3-5KG/Tree/Year

Oman Blend Field Experiments

Crops: Tomato

Location: Oman, Musanah



Oman Blend Field Experiments

Crops: Alfalfa

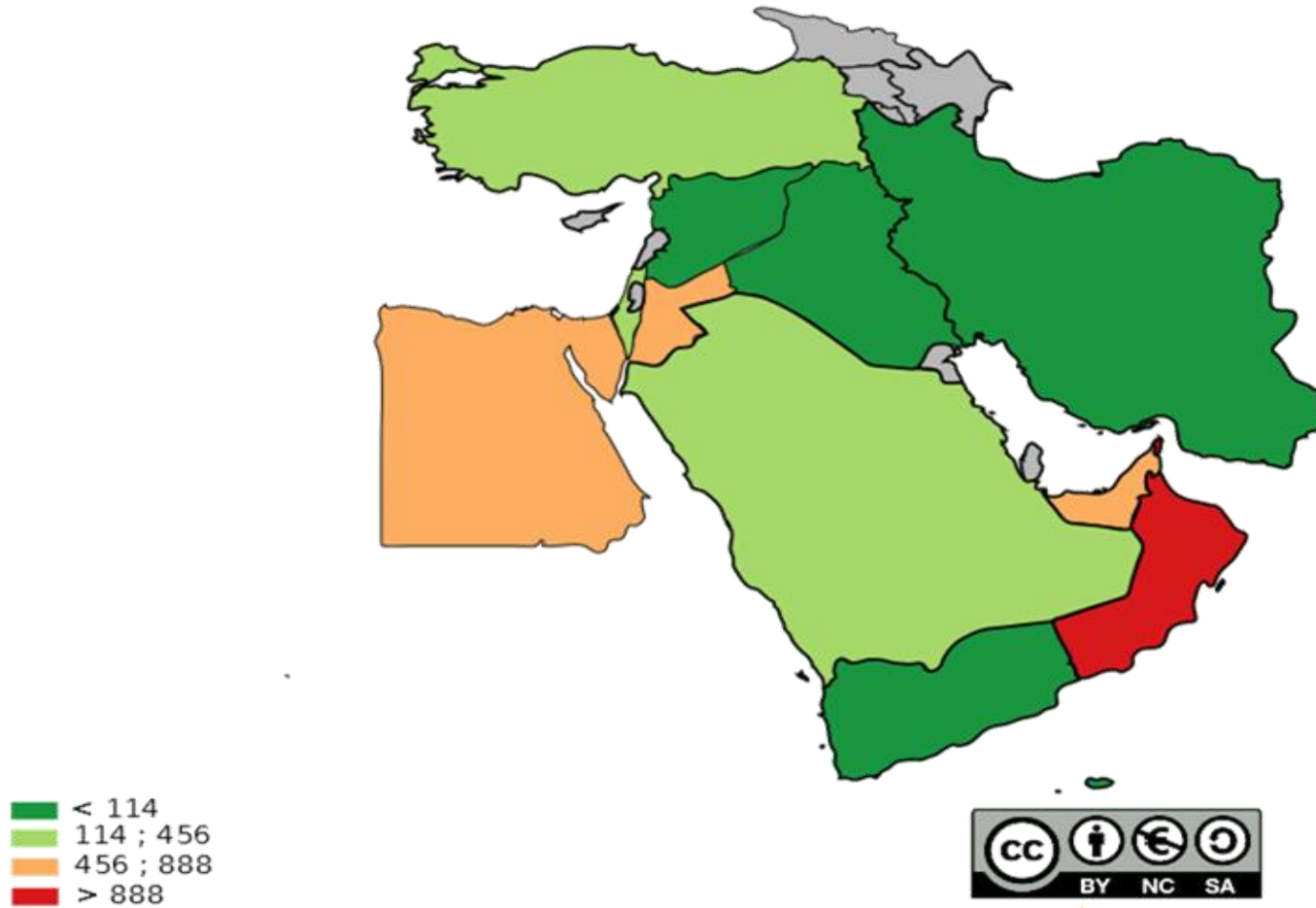
Location: Oman, Khaboura



Sulphur Bentonite 90% application in NZ



Fertilizers Usage in Middle East



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