Lecture 10: Secondary and Micro Nutrient Fertilizers

A. Secondary nutrient fertilizers

I. CALCIUM FERTILIZER:

Nearly all multi nutrient liquid fertilizer formulations and more than 50 per cent multi nutrient solid fertilizers are almost devoid of calcium .Multi nutrient fertilizers use, warrants the use of calcium. The source of calcium with basic chemical formula, its content and solubility are mentioned in the following table.

Table: Basic chemical data of various calcium sources:

S.No.	Source	Formula	Ca (%)	Water solubility g /100 g at 25 ^{o}C
1	Burnt lime	CaO	70	0.12
2	Hydrated lime	$Ca(OH)_2$	50	0.16
3	Calcite lime	$CaCO_3$	36	0.01
4	Dolamitic lime	$CaCO_3$ Mg CO_3	17	>0.1
5	Basic slag	$[CaO]_5$ P_2O_5 SiO_2	29	>0.1
6	Gypsum	$CaSO_4$ $2H_2O$	22	0.24
7	Calcium nitrate	$Ca(NO_3)_2 2H_2O$	20	100
8	Single Super phosphate	$Ca(H_2PO_4)_2$ $CaSO_4$	20	1.0
9	Triple super phosphate	$Ca(H_3PO_4)_2$	13	1.80
10	Rock phosphate	$Ca_5(PO_4)_3F$	33	0.002
11	Calcium chloride	$CaCl_2$	36	100.00

Of the different sources, the Gypsum has been gaining importance for crops such as legumes. Global reserves of Ca are considerably large since whole mountain ranges consist of lime stone. Calcium nick named as root developer, which is slightly mobile in plants .Calcium deficiency in plants is rarely caused by shortage of available reserves in the soil , except in acidic soils.

II. MAGNESIUM FERTILIZERS:

In multi nutrient fertilizers, finely ground dolamitic limestone is used as filler and it is a incidental supplier of Mg.

S.No.	Source	Formula	Mg (%)	Water solubility g
				/100 grams at 25 ^{o}C
1	Magnesium oxide	MgO	45	6.2 x10 $^{-5}$
2	Dolamite	$CaCO_3$ $MgCO_3$	12	0.032
3	Kiserite	$MgSO_4$ H_2O	18.2	68.40
4	Langbeinite	K_2SO_4 $2MgSO_4$	11.2	100.0
5	Magnesium sulphate	$MgSO_4$ $7H_2O$	10.5	91.10

III.SULPHUR FERTILIZERS:

Plants take sulphur in the form of sulphate [SO_4^{2-}] ion. Sulphur fertilizers predominately contain sulphate , some of which are easily soluble and some are slightly soluble Gypsum [$CaSO_4$ $2H_2O$] is a calcium sulphate because its slight solubility in water which is slow acting .Elemental sulphur is also an important sulphur fertilizer with strong acidifying action. It can be used either directly or as an additive to other solid fertilizers eg sulphur coated urea .The following table gives the basic chemical data of sulphur sources

S.No.	Source	Formula	S (%)
1	Ammonium sulphate	$(NH4)_2$ SO_4	23
2	Potassium sulphate	K_2SO_4	18
3	Magnesium sulphate	$MgSO_4$	13
4	Super phosphate	$Ca(H_2PO_4)_2$ $CaSO_4$	12
5	Gypsum	$CaSO_4$ $2H_2O$	18
6	Aluminium sulphate	$Al_2(SO_4)_3 18H_2O$	14

The sulphur requirements of plants are approximately 2/3 of their phosphorus requirements and are provided from various sources such as air, rain water ,soil and fertilizer .Fields near Industrial zones are supplied with 10-30 kg ha^{-1} per year from SO_2 waste gases .

MICRONUTRIENT FERTILIZERS

Sources of micronutrients:

S.No.	Micronutrients	Formula	Content (%)	Method of application
A	**IRON**			They are predominantly applied as foliar sprays, however this requires repeated application.
	1.Ferrous sulphate	$FeSO_4$ $7H_2O$	20	
	2.Fe-chelate	Fe-EDTA	5	
	3.Fe-Chelate	FeEDHA	6	
B	**MANGANESE**			They are predominantly applied as foliar sprays, however this requires repeated application.
	1. Manganous sulphate	Mn SO_4 4 H_2 O	24	
	2.Manganous sulphate (Monohydrate)	Mn SO_4 H_2 O	32	
	3. Mn -chelate	Mn-EDTA	13	
C	**ZINC**			It is acidic in reaction and causes leaf scorch on foliar application unless free acidity in neutralized with lime.
	1.Zinc sulphate	$ZnSO_4$ $7H_2O$	23	
	2.Zinc sulphate (Monohydrate)	$ZnSO_4$ H_2O	36	
	3.Zn-chelate	Zn-EDTA	14	
D	**COPPER**			It can be applied as soil dressing or foliar nutrient .
	1.Copper sulphate	Cu SO_4 $5H_2O$	25	
	2.Copper sulphate (Monohydrate)	Cu SO_4 H_2O	36	

E	**BORON**			It can be applied to soil or foliage
	1. Borax (Na-tetra borate)	$Na_2B_4O_7$ $10H_2O$	11	
	2.Borax anhdrous	$Na_2\ B_4O_7$	22	
	3.Boric acid	H_3BO_3	18	
F	**MOLYBDENUM**			suitable for soil or foliar application and also for seed treatment
	1 Sodium molybdate	$Na2MoO_4$ $2H_2O$	40	
	2.Ammonium molybdate	$(NH4)_6MoO_{24}$	54	
	3Molydenum trioxide	MoO_3	66	
	4.Calcium molybdate	$CaMoO_4$	48	