Contents

About the book	5
About the authors	5
Acknowledgements	7
List of abbreviations, acronyms, and symbols	7
1. Introduction and scope 1.1. A brief history of foliar fertilization	10 10
2. Mechanisms of penetration into the plant	12
2.1. Role of plant morphology and structure	15
2.1.1. Cuticles and their specialized epidermal structures	15
2.1.2. Effect of topography: micro- and nano-structure of the plant surface	18
2.2. Pathways and mechanisms of penetration	20
2.2.1. Cuticular permeability	20
2.3. Conclusions	25
 3. Physico-chemical properties of spray solutions and their impact on penetration 3.1. Factors determining spray retention, leaf wetting, spreading and rate of 	27
penetration	28
3.1.1. Concentration	28
3.1.2. Solubility	28
3.1.4. Electric charge	29
3.1.5. Solution pH	30
3.1.6. Point of deliguescence	30
3.2. Environment	31
3.3. Formulations and adjuvants	32
3.3.1. Mineral compounds applied as foliar sprays	32
3.3.2. Formulation additives: adjuvants	33
3.4. Conclusions	40
4. Environmental, physiological and biological factors affecting plant response to foliar fertilization	42
4.1. Introduction	42
4.2. Leaf age, leaf surface, leaf ontogeny, leaf homogeneity and canopy development	44

4.3. Plant species and variety	49
4.4. Effect of the environment on efficacy of foliar-applied nutrients	53
4.4.1. Light	53
4.4.2. Temperature	55
4.4.3. Humidity	56
4.5. Summary of the effects of the environment on plant response to foliar	F.0.
A C Nutrient mobility and transmert	59
4.6. Nutrient mobility and transport	6U 70
4.7. Conclusions	70
5. Years of practice – learning from the field	72
5.1. Spray application technology	72
5.2. Foliar formulations and application technology	74
5.3. Biological rationale for the use of foliar fertilizers	74
5.3.1. Role of crop phenology and the environment on plant response	75
5.3.2. Influence of the environment on the efficacy of foliar applications	
during spring	76
5.3.3. Efficacy of foliar applications for flowering and grain set in field crops	81
5.3.4. Foliar fertilization during peaks of nutrient demand	83
5.3.5. Post-narvest and late season sprays	8/
5.5.6. Folial teruization and crop quality	0/
5.4. Impact of plant nutritional status on emicacy of foliar fertilizers	88
5.5. Source and formulation of nutrients for foliar spray	91
5.6. IOXICITY	94
5.7. Conclusions	99
6. Regulatory and environmental considerations	101
6.1. Regulatory matters	101
6.2. Environmental and food quality considerations	102
6.3. Conclusions	104
7. Perspectives of foliar fertilization	106
7.1. Conclusions	108
8. References	112