

Contents

1. General introduction	1
1.1. Secondary plant metabolites	1
1.1.1. Carotenoids	2
1.1.1.1. Nature and occurrence	2
1.1.1.3. Importance to humans	3
1.1.2. Glucosinolates	4
1.1.2.1. Nature and occurrence	4
1.1.2.2. Importance to plants	5
1.1.2.3. Importance to humans	5
1.2. Some factors that may affect secondary metabolism in vegetable crops	6
1.2.1. Environmental factors	7
1.2.2. Agronomic practices	7
1.2.2.1. Fertilization	8
1.2.2.2. AM fungal inoculation	9
1.2.2.3. Intercropping	11
1.2.2.4. Irrigation	12
1.3. Objectives	13
2. General materials and methods	16
2.1. Description of plant growth substrate	16
2.2. Preparation of fungal compartment substrate	17
2.3. Estimation of the AM fungal colonized root length	17
2.4. Extraradical mycelium and spores estimation	17
2.5. Plant secondary metabolites analysis	18
2.5.1. Analysis of β -carotene	18
2.5.2. Analysis of glucosinolate	18
2.6. Nutrients analysis	19

3. Effects of single and mixed inoculation with two arbuscular mycorrhizal fungi in two different levels of phosphorus supply on β -carotene concentrations in sweet potato (<i>Ipomoea batatas</i> L.) tubers.....	21
3.1. Abstract.....	21
3.3. Materials and methods.....	24
3.3.1. Plant material, split-root system and growth conditions.....	24
3.3.2. Experimental setup.....	26
3.3.3. Fungal compartment preparation.....	27
3.3.4. Harvest and sample preparation.....	28
3.3.5. Statistical analysis.....	28
3.4. Results.....	28
3.4.1. Intra- and extraradical AM fungal development.....	28
3.4.2. Plant growth.....	32
3.4.3. Concentration of mineral nutrients.....	32
3.4.4. Concentration and content of β -carotene.....	33
3.5. Discussion.....	35
3.6. Conclusion.....	40
4. Interactive effects of arbuscular mycorrhizal fungi and intercropping with sesame (<i>Sesamum indicum</i>) on the glucosinolate profile in broccoli (<i>Brassica oleracea</i> var. <i>italica</i>).....	42
4.1. Abstract.....	42
4.3. Materials and methods.....	44
4.3.1. Plant material, three-compartment split-root system and growth conditions.....	44
4.3.2. Fungal compartment preparation and ^{15}N labelling.....	47
4.3.3. Harvest and sample preparation.....	47
4.3.4. Statistical analysis.....	48
4.4. Results.....	48
4.4.1. Intra- and extraradical AM fungal development.....	48
4.4.2. Plant growth.....	50
4.4.3. Concentration of mineral nutrients.....	51
4.4.4. Concentration of glucosinolate.....	51

4.5. Discussion	56
4.6. Conclusion	62
5. Topsoil drying effect on Indian mustard (<i>Brassica juncea</i>) performance	63
5.1. Effect of topsoil drying on Indian mustard (<i>Brassica juncea</i>) growth and mineral element concentrations under two nitrogen forms and two sulfur supply levels	63
5.1.1. Abstract	63
5.1.2. Introduction	64
5.1.3. Materials and methods	66
5.1.3.1. Plant material, vertical split-root system and growth conditions	66
5.1.3.2. Establishment of the different treatments	67
5.1.3.3. Harvest and sample preparation	68
5.1.3.4. Statistical analysis	69
5.1.4. Results	69
5.1.4.1. Plant biomass	69
5.1.4.2. Plant nutrition	69
5.1.5. Discussion	73
5.1.6. Conclusion	77
5.2. Topsoil drying combined with increased sulfur supply leads to enhanced aliphatic glucosinolates in <i>Brassica juncea</i> leaves and roots	78
5.2.1. Abstract	78
5.2.2. Introduction	79
5.2.3. Materials and methods	81
5.2.3.1. Plant material, vertical split-root system and growth conditions	81
5.2.3.2. Establishment of the different treatments	81
5.2.3.3. Harvest and sample preparation	82
5.2.3.4. Absciscic acid analysis	83
5.2.3.5. Statistical analysis	83
5.2.4. Results	84
5.2.4.1. Plant biomass	84
5.2.4.2. The N/S ratio	85

5.2.4.3. Concentration of glucosinolates.....	85
5.2.4.4. Concentration of abscisic acid	89
5.2.5. Discussion	90
5.2.6. Conclusion	94
6. General discussion	95
6.1. Functional differences between AM fungal species	95
6.2. Interactive effect of AM fungi and plant species in a mixed cropping system.....	97
6.3. Topsoil drying effects on plant secondary metabolism	100
7. Summary/Zusammenfassung.....	102
7.1. Summary	102
7.2. Zusammenfassung.....	107
8. References.....	112
9. Acknowledgments.....	135