



Annika Meißner (Autor)

# **Water use efficiency of arable and grassland crops in legume-based intercropping systems**

Institute of Applied Plant Nutrition  
Göttingen



Annika Meißner

---

**Water use efficiency of arable and  
grassland crops in legume-based  
intercropping systems**

---

04/2021



<https://cuvillier.de/de/shop/publications/8467>

Copyright:  
Cuvillier Verlag, Inhaberin Annette Jentsch-Cuvillier, Nonnenstieg 8, 37075 Göttingen,  
Germany  
Telefon: +49 (0)551 54724-0, E-Mail: [info@cuvillier.de](mailto:info@cuvillier.de), Website: <https://cuvillier.de>

**Contents**

Contents ..... I

List of manuscripts ..... III

List of relevant abbreviations ..... IV

Chapter 1: Prologue ..... 1

    1.1 Legumes in cropping systems ..... 1

    1.2 Intercropping systems ..... 1

        1.2.1 Intercropping with faba bean ..... 2

        1.2.2 Intercropping with white clover and chicory ..... 3

    1.3 Drought and water use ..... 4

        1.3.1 Water use efficiency on the physiological level ..... 4

        1.3.2 Water use efficiency of the crop stand via remote sensing ..... 5

    1.4 Objectives and structure of the thesis ..... 6

Chapter 2 ..... 13

    Chapter 2.1: The cropping system matters – Contrasting responses of winter faba bean (*Vicia faba* L.) genotypes to drought stress ..... 14

    Chapter 2.2: Crop genotype and plant compartment determine the response of the active bacterial community towards water deficit ..... 44

    Chapter 2.3: Response of the active bacterial and fungal communities in the rhizosphere differ towards water deficit ..... 83

    Chapter 2.4: Crop species and cropping system alter the effect of *Metarhizium brunneum* seed application on plant-associated bacterial and fungal communities ..... 119

Chapter 3: Intercropping with winter faba bean in arable land and white clover in grassland improves water use efficiency of the cropping system ..... 158

Chapter 4: Legume-based mixed intercropping systems may lower agricultural born N<sub>2</sub>O emissions ..... 184

Chapter 5: Remotely assessed vegetation development and water use of arable and grassland intercropping with legumes ..... 194

Chapter 6: Epilogue .....	223
6.1 Intercropping with arable crops .....	223
6.2 Intercropping with grassland crops .....	224
6.3 Drought stress tolerance.....	225
6.4 Breeding for intercropping.....	226
6.4.1 Genotypes of winter faba bean .....	227
6.4.2 Genotypes of white clover.....	228
6.5 Technical aspects .....	229
6.6 Concluding remarks .....	230
Summary.....	235
Further publications.....	238
Acknowledgments .....	240
Appendix .....	242
Supplementary material for chapter 2.1 .....	242
Supplementary material for chapter 2.2 .....	259
Supplementary material for chapter 2.3 .....	260
Supplementary material for chapter 2.4 .....	261
Supplementary material for chapter 3 .....	266
CV.....	274
Declarations .....	276