



Robin Mink (Autor)

Implementation and Evaluation of Unmanned Aerial Vehicles and Sensor Systems in Weed Research

Robin Mink

**Implementation and Evaluation
of Unmanned Aerial Vehicles and
Sensor Systems in Weed Research**



Cuvillier Verlag Göttingen
Internationaler wissenschaftlicher Fachverlag

<https://cuvillier.de/de/shop/publications/8201>

Copyright:

Cuvillier Verlag, Inhaberin Annette Jentsch-Cuvillier, Nonnenstieg 8, 37075 Göttingen,
Germany

Telefon: +49 (0)551 54724-0, E-Mail: info@cuvillier.de, Website: <https://cuvillier.de>



Contents

Zusammenfassung	iii
Summary	vii
1 General Introduction	1
1.1 Objectives	4
1.2 Structure of the Dissertation	4
2 Research Articles	7
2.1 1 st Study: Multi-Temporal Site-Specific Weed Control of <i>Cirsium arvense</i> (L.) Scop. and <i>Rumex crispus</i> L. in Maize and Sugar Beet Using Unmanned Aerial Vehicle Based Mapping	7
2.1.1 Introduction	9
2.1.2 Materials and Methods	10
Trial Sites and Precision Sowing	10
Ground-Truth Weed Mapping	11
UAV and Sensor Setup	12
Image Processing	12
Generating Weed Control Maps Based on UAV Imagery	13
Site-Specific Herbicide Application in Field Trials	16
2.1.3 Results	19
2.1.4 Discussion	22
2.1.5 Conclusions	25
2.2 2 nd Study: Sensor-based Evaluation of Maize (<i>Zea mays</i>) and Weed Response to Postemergence Herbicide Applications of <i>Isoxaflutole</i> and <i>Cyprosulfamide</i> Applied as Crop Seed Treatment or Herbicide Mixing Partner	27
2.2.1 Introduction	29
2.2.2 Materials and Methods	30
Experimental Design	30
Data Collection	33



	Data Processing and statistics	34
2.2.3	Results	35
	Greenhouse ground-truth	35
	Greenhouse spectrometry	36
	Field ground-truth	40
	UAV field spectrometry	42
2.2.4	Discussion	45
2.2.5	Conclusion	48
2.3	3 rd Study: In-field Classification of Herbicide-resistant <i>Papaver rhoeas</i> and <i>Stellaria media</i> using an Imaging Sensor of the Maximum Quantum Efficiency of Photosystem II	49
2.4	4 th Study: Discrimination between herbicide resistant and sensitive <i>Stellaria media</i> plants using hyperspectral plant reflectance and artificial neural network weight analysis	51
	2.4.1 Introduction	53
	2.4.2 Materials and Methods	55
	Plant Material and Herbicide Treatment	55
	Field Trials	56
	Spectrometer Measurements	56
	Artificial Neural Network Training and Classification	57
	Artificial Neural Network Neuron Weight Analysis and Input Reduction	58
	2.4.3 Results	59
	Training and Validation	59
	Neuron Weight Analysis	61
	2.4.4 Discussion	62
	2.4.5 Conclusion	65
3	General Discussion	67