



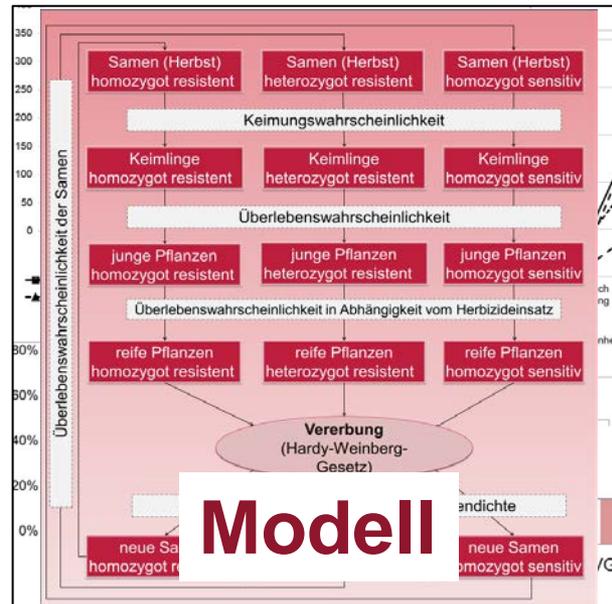
Technische
Universität
Braunschweig



Auswirkungen verschiedener Herbizidstrategien auf eine ALS-resistente Windhalmpopulation – Ergebnisse eines 6-jährigen Feldversuchs

Janin Rummland, 11.12.2014

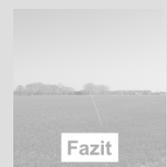
Gliederung





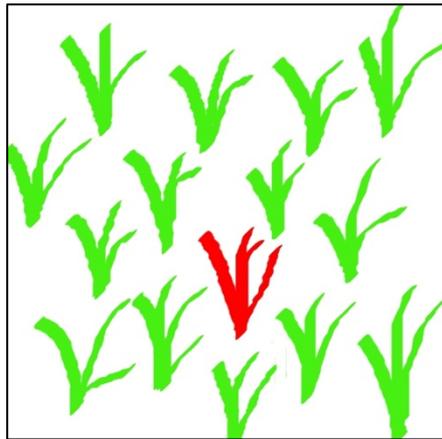
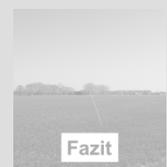
Einleitung



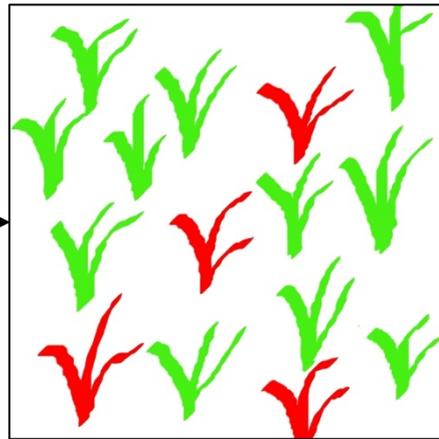


Motivation

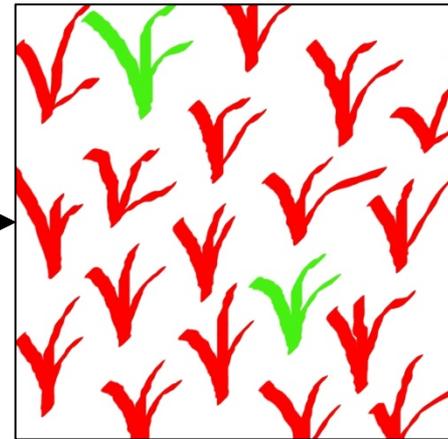
- besseres Verständnis der Resistenzentwicklung beim Windhalm
- Entwicklung eines Modells welches die Resistenzentwicklung abbilden kann



Anfangspopulation



Selektionsprozess



resistente Population

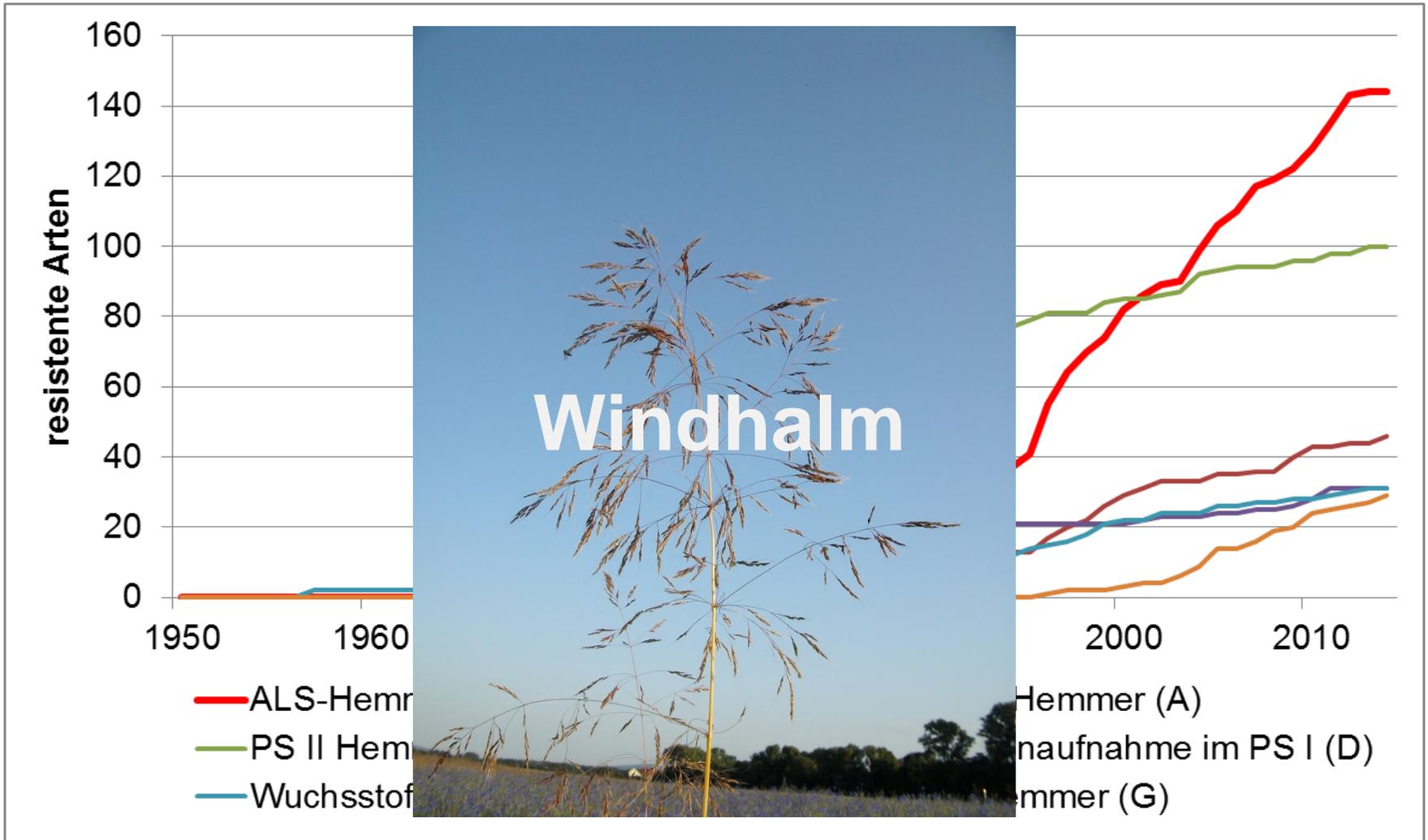
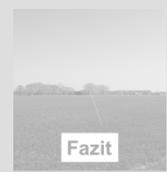


sensitive Pflanze



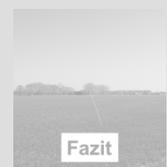
resistente Pflanze

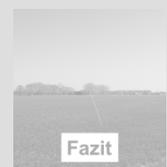






Feldversuch

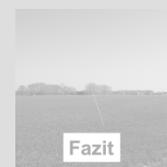




Feldhistorie

Jahr	Frucht	Herbizid	HRAC-Gruppe
2008	Winterweizen	Sumimax	E
		Atlantis	B
		Starane XL	O, B
2007	Winterweizen	Atlantis WG	B
		Atlantis WG	B
2006	Winterweizen	Lexus	B
		Stomp	K1
		Pointer	B
2005	Winterraps	Nimbus	K3, F3
		Round up	G

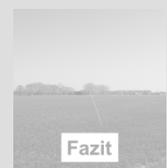
Jahr	Frucht	Herbizid	HRAC-Gruppe
2004	Winterweizen	Bacara	F1
		MCPA	O
2003	Körnererbsen	Bandur	F3
2002	Winterweizen	IPU	C2
		Stomp SC	K1
2001	Winterraps	Butisan Top	K3, O
2000	Winterweizen	Herold	F1, K3
1999	Zuckerrüben		
1998	Winterweizen		



Feldhistorie

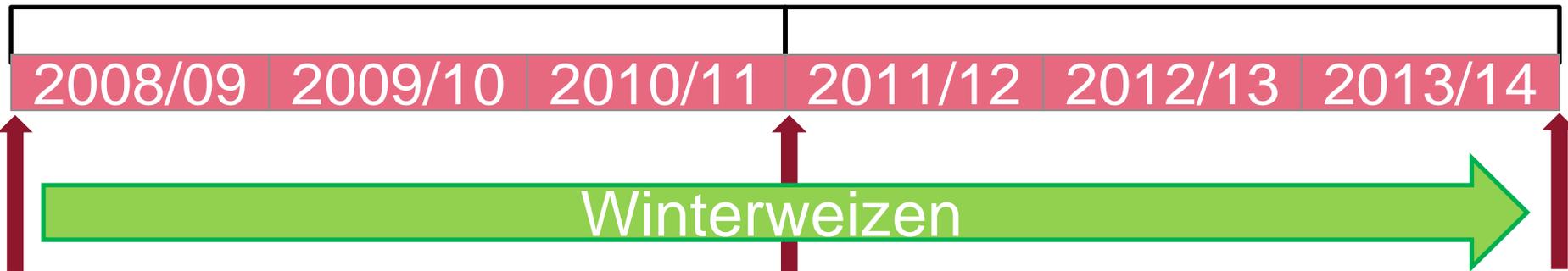
Jahr	Frucht	Herbizid	HRAC-Gruppe
2008	Winterweizen	Sumimax	E
		Atlantis	B
		Starane XL	O, B
2007	Winterweizen	Atlantis WG	B
		Atlantis WG	B
2006	Winterweizen	Lexus	B
		Stomp	K1
		Pointer	B
2005	Winterraps	Nimbus	K3, F3
		Round up	G

Jahr	Frucht	Herbizid	HRAC-Gruppe
2004	Winterweizen	Bacara	F1
		MCPA	O
2003	Körnererbsen	Bandur	F3
2002	Winterweizen	IPU	C2
		Stomp SC	K1
2001	Winterraps	Butisan Top	K3, O
2000	Winterweizen	Herold	F1, K3
1999	Zuckerrüben		
1998	Winterweizen		



1. Versuchsabschnitt

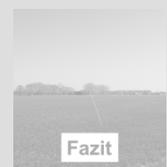
2. Versuchsabschnitt



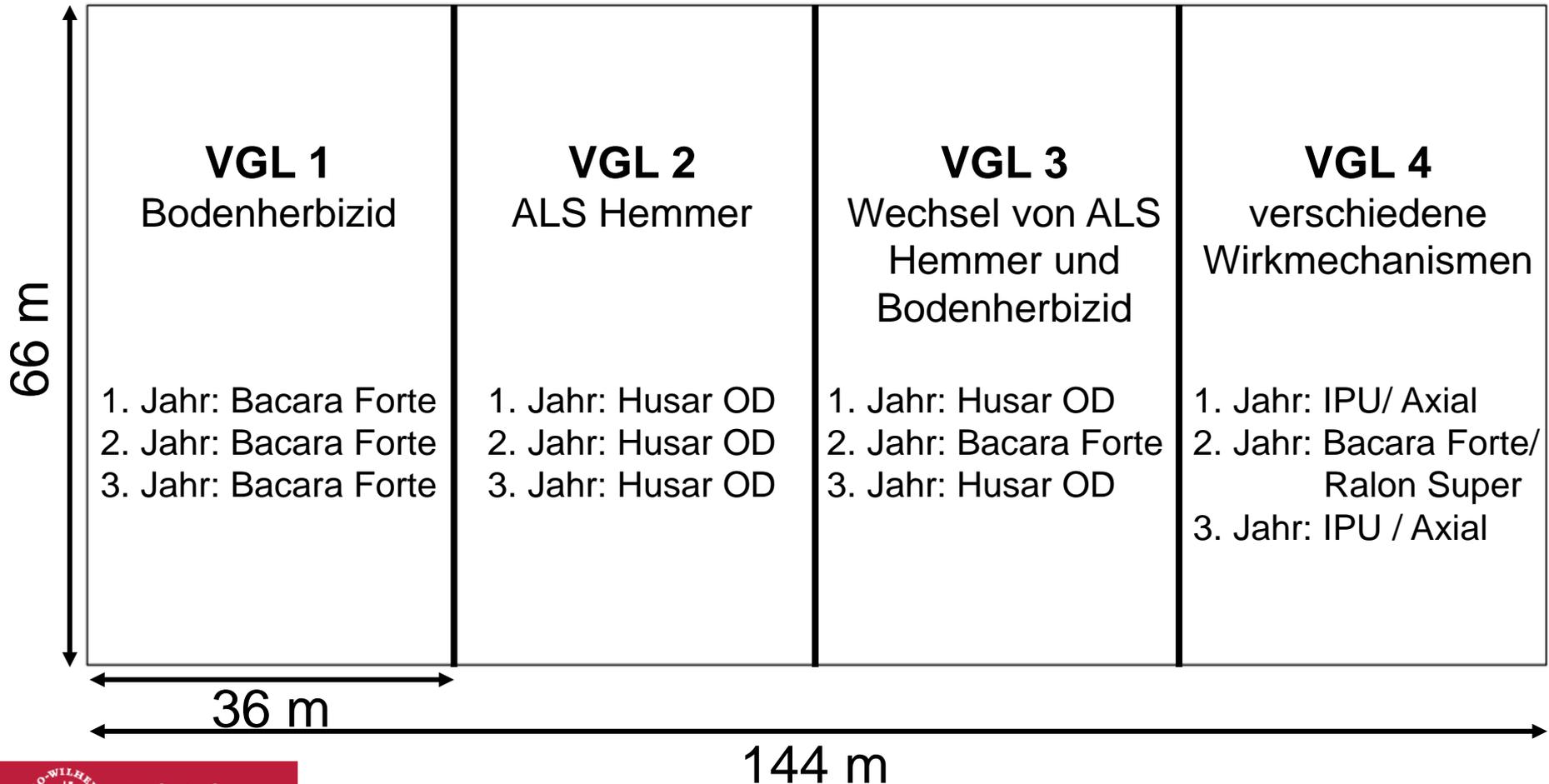
Bodenentnahme,
Samenpotential

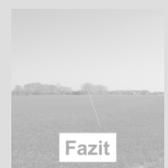
Bodenentnahme,
Samenpotential

Bodenentnahme,
Samenpotential



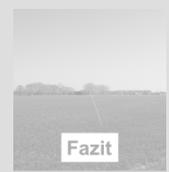
Versuchsaufbau – 1. Teil (Jahr 1 bis 3)





Versuchsaufbau – 2. Teil (Jahr 4 bis 6)





1. Versuchsabschnitt

VGL 1
Bodenherbizid

Bacara Forte

VGL 2:
ALS-Hemmer

Husar OD

VGL 3:
ALS-Hemmer/
Bodenherbizid

Husar OD (1. u. 3. Jahr)
Bacara Forte (2. Jahr)

VGL 4:
verschiedene
Wirkmechanismen

IPU/Axial (1. u. 3. Jahr)
*Bacara FORTE/
Ralon Super (2. Jahr)*

C/1	C/2	C/3	C/4
B/1	B/2	B/3	B/4
A/1	A/2	A/3	A/4

VGL C:
Bodenherbizid
Bacara Forte u. Atlantis

VGL B:
Bodenherbizid + weiteren
Wirkmechanismus
*Bacara Forte u. Atlantis
u. Axial*

VGL A:
ALS-Hemmer
Atlantis

2. Versuchsabschnitt



Einleitung



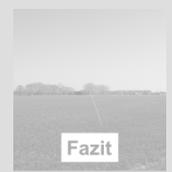
Feldversuch



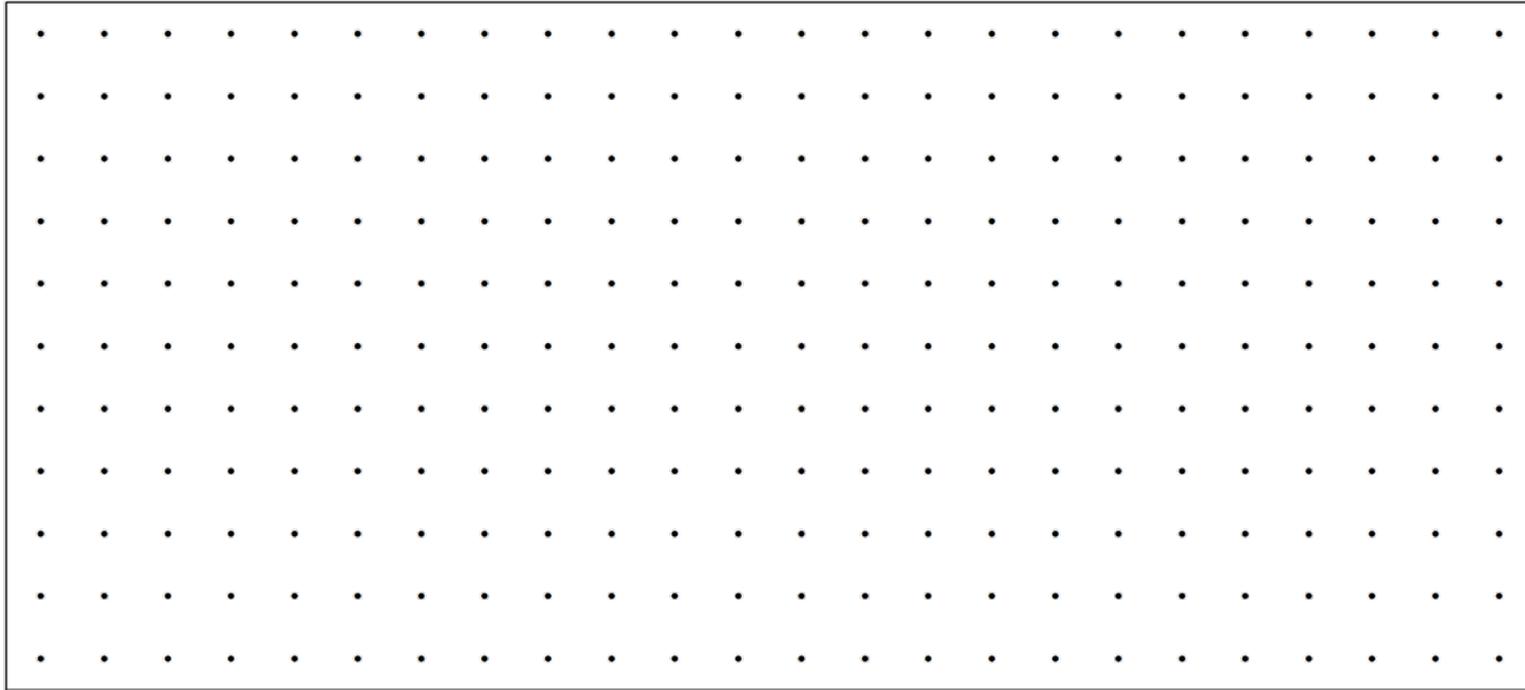
Ergebnisse



Modell



Fazit





Einleitung



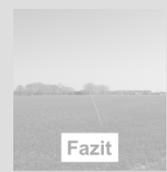
Feldversuch



Ergebnisse



Modell



Fazit





Einleitung



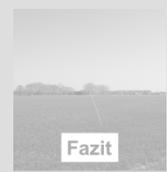
Feldversuch



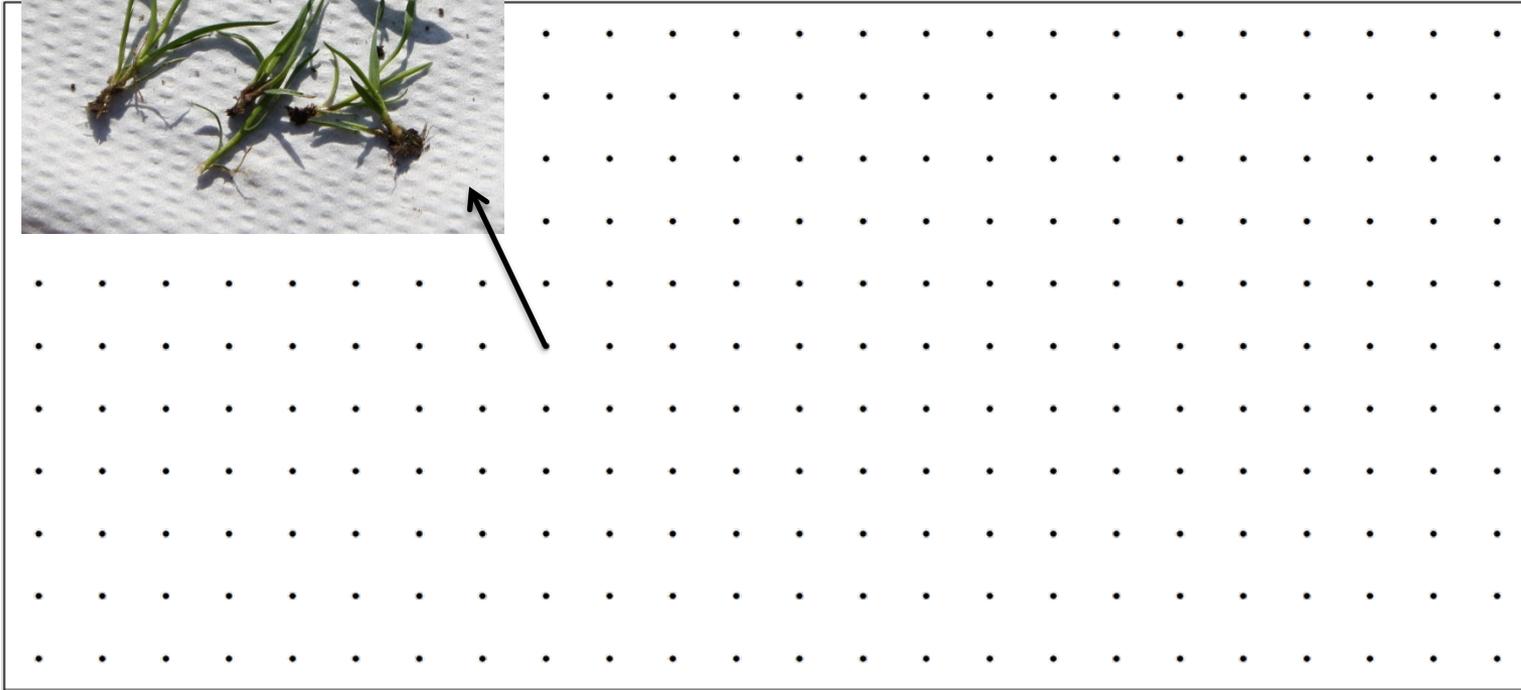
Ergebnisse

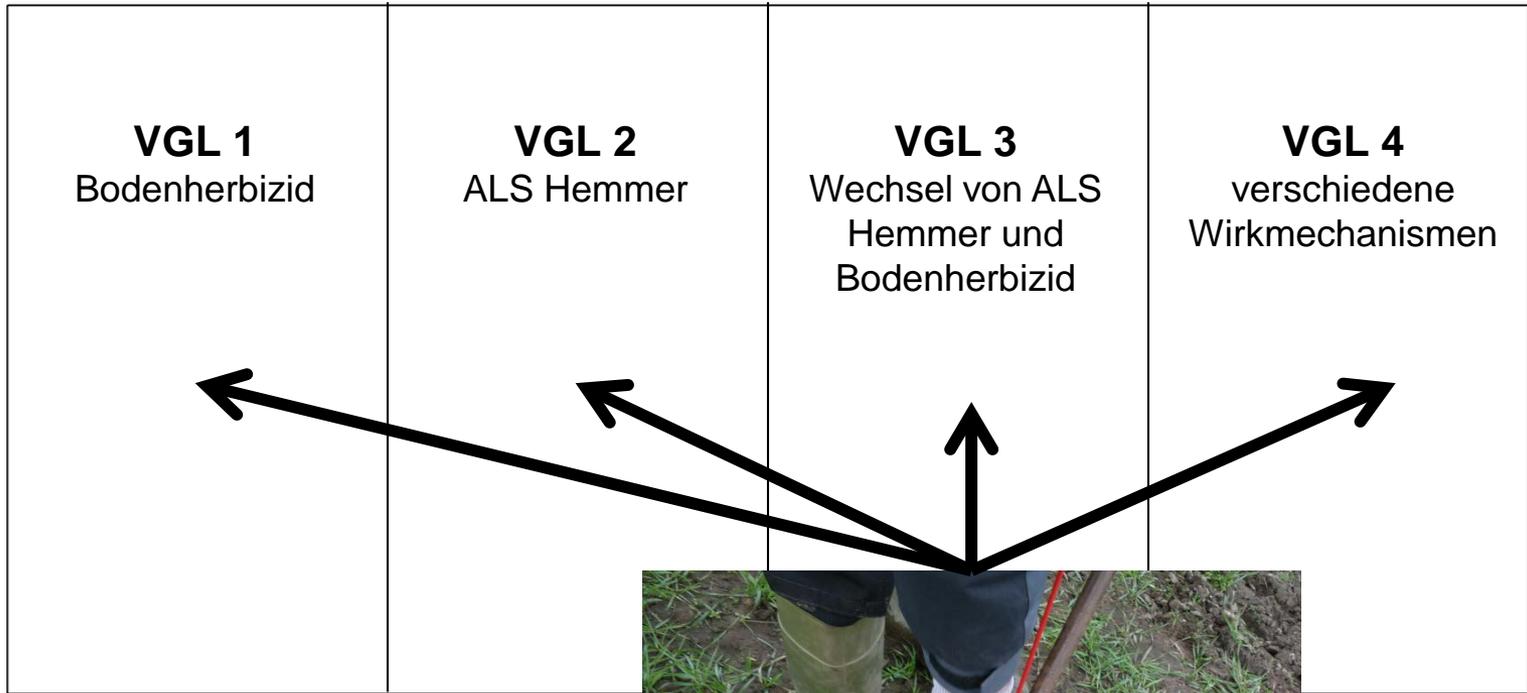
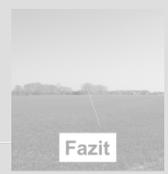


Modell



Fazit





Entnahmetiefe: 0-20 cm





Einleitung



Feldversuch



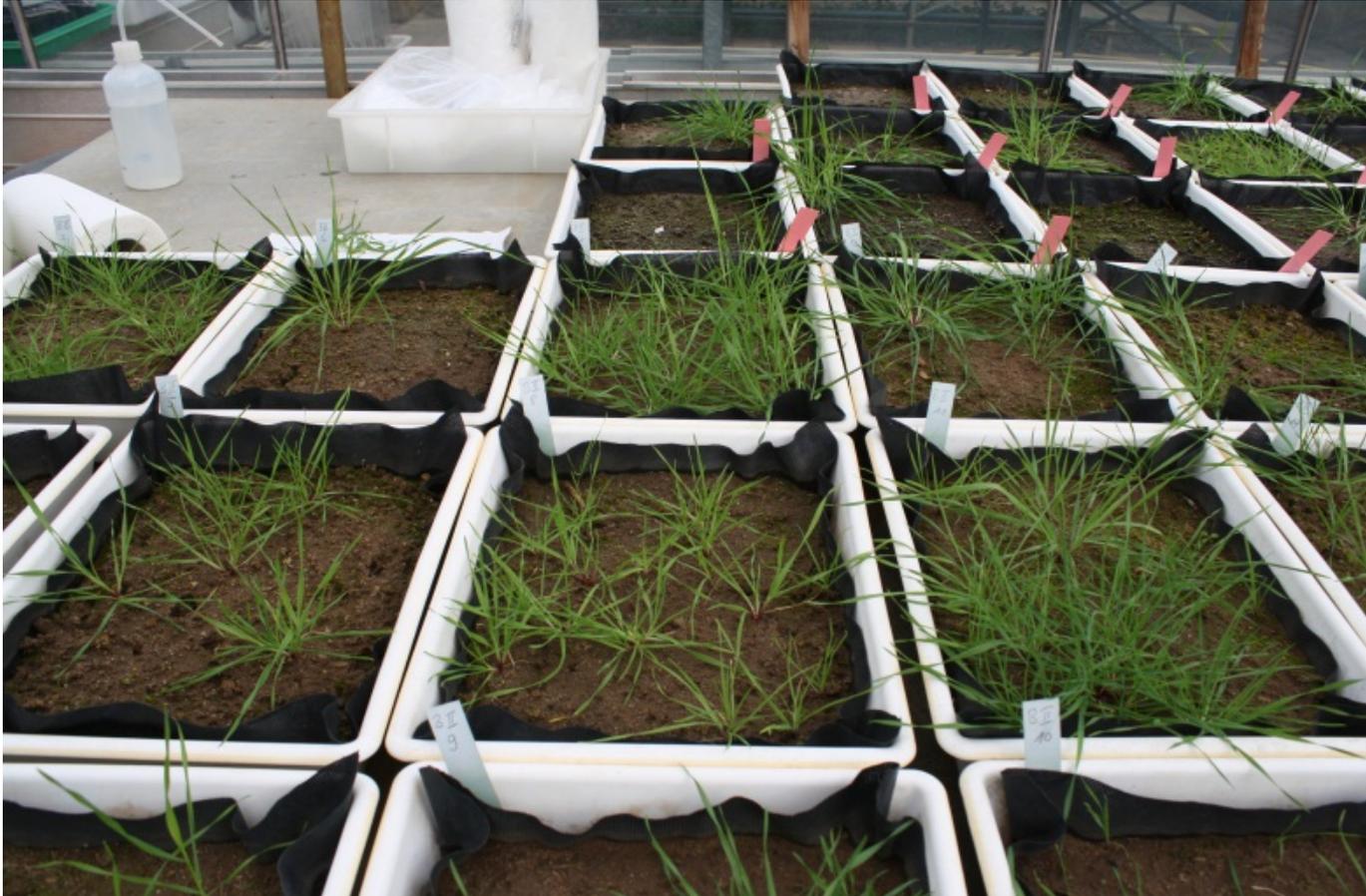
Ergebnisse

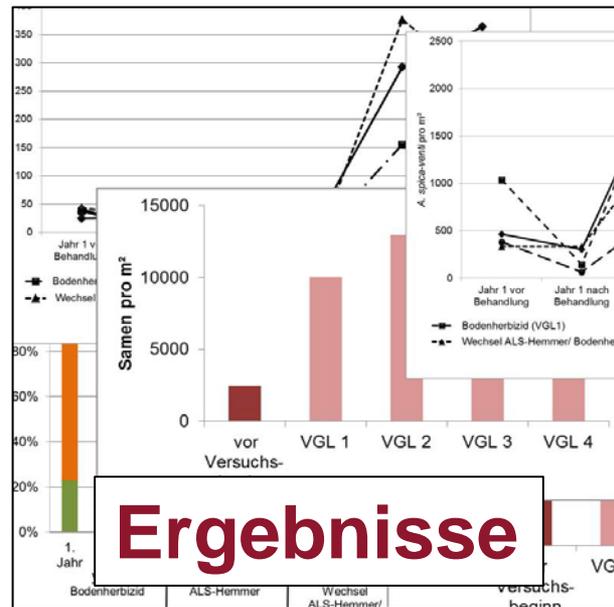


Modell



Fazit





Bonitur - 1. Versuchsabschnitt

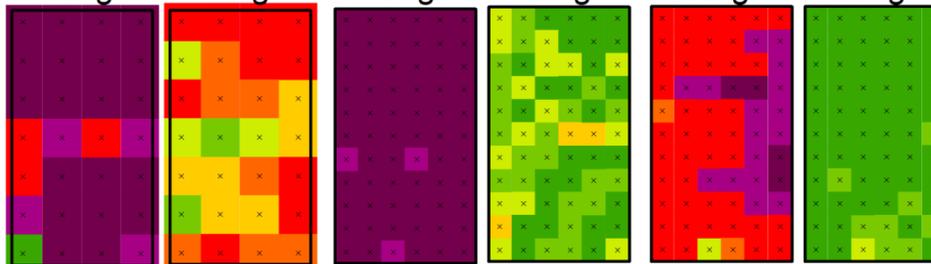
Jahr 1

Jahr 2

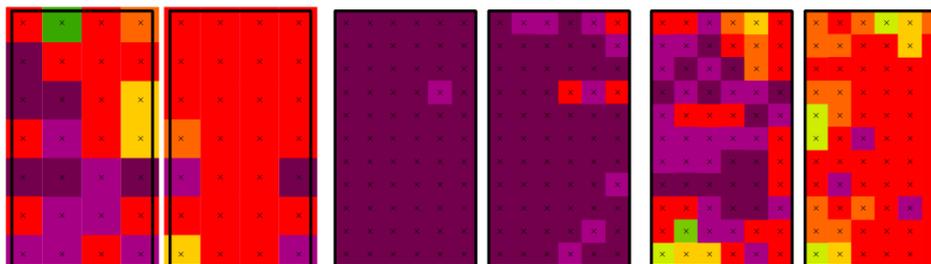
Jahr 3

vor nach vor nach vor nach
Behand- Behand- Behand- Behand- Behand- Behand-
lung lung lung lung lung lung

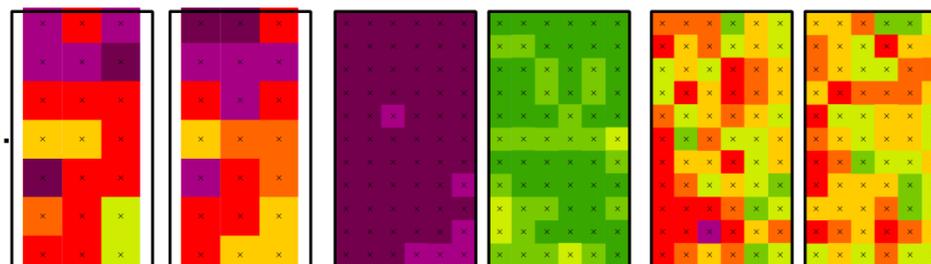
VGL 1:
Bodenherbizid



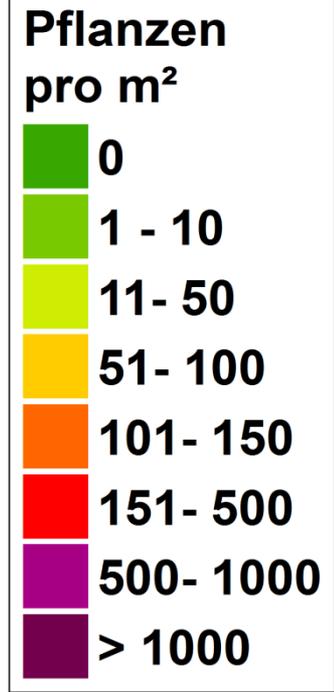
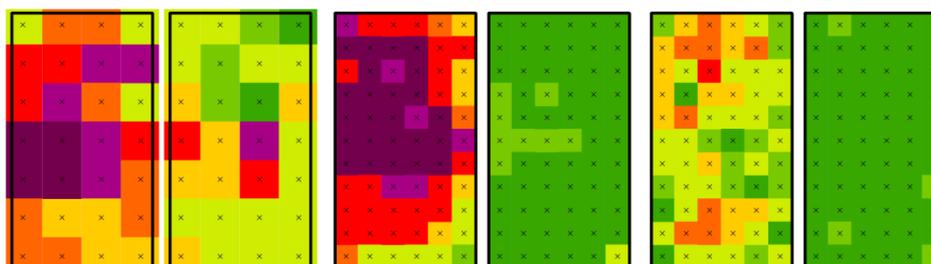
VGL 2:
ALS-Hemmer



VGL 3:
Wechsel zw.
Bodenherbizid u.
ALS-Hemmer



VGL 4:
Herbizide mit
verschiedenen
Wirkorten
im Wechsel

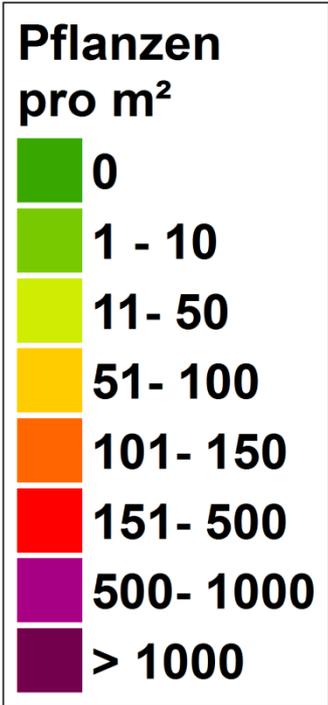
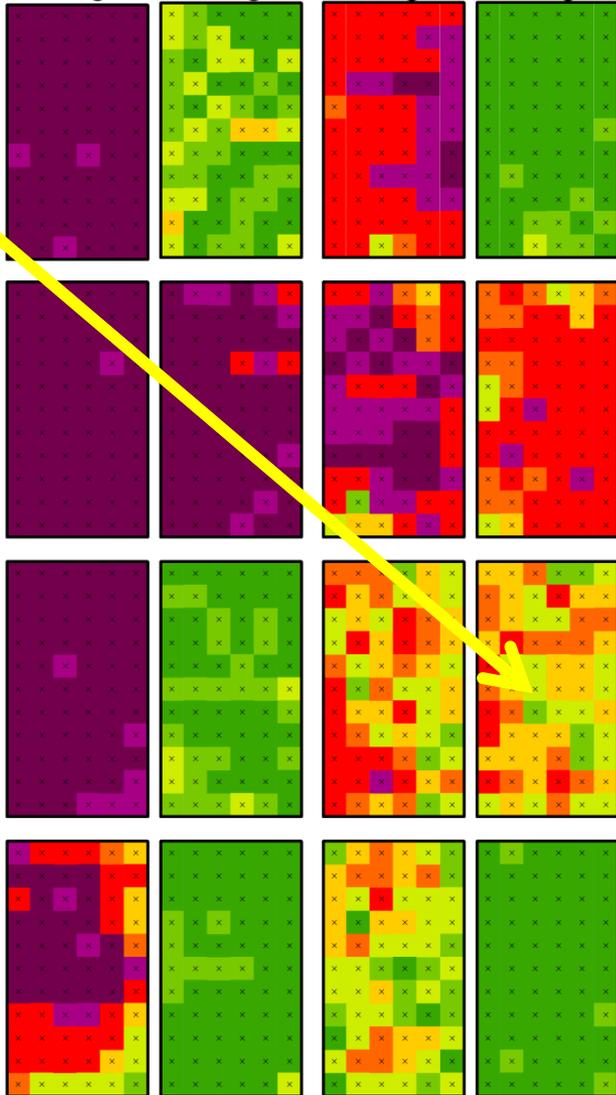




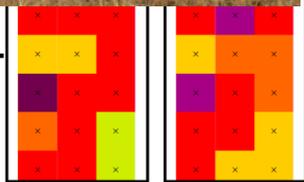
Jahr 2

Jahr 3

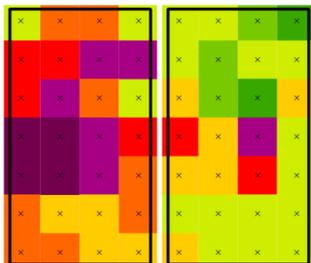
vor Behandlung nach Behandlung vor Behandlung nach Behandlung



**wechsel zw.
Bodenherbizid u.
ALS-Hemmer**



**VGL 4:
Herbizide mit
verschiedenen
Wirkorten
im Wechsel**



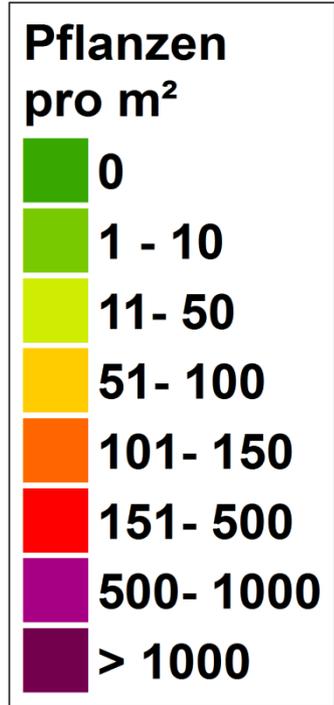
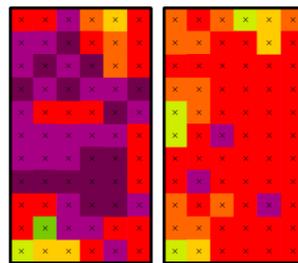
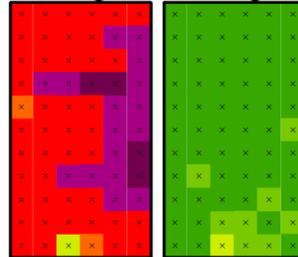
Jahr 1

Jahr 2

Jahr 3



vor Behandlung nach Behandlung

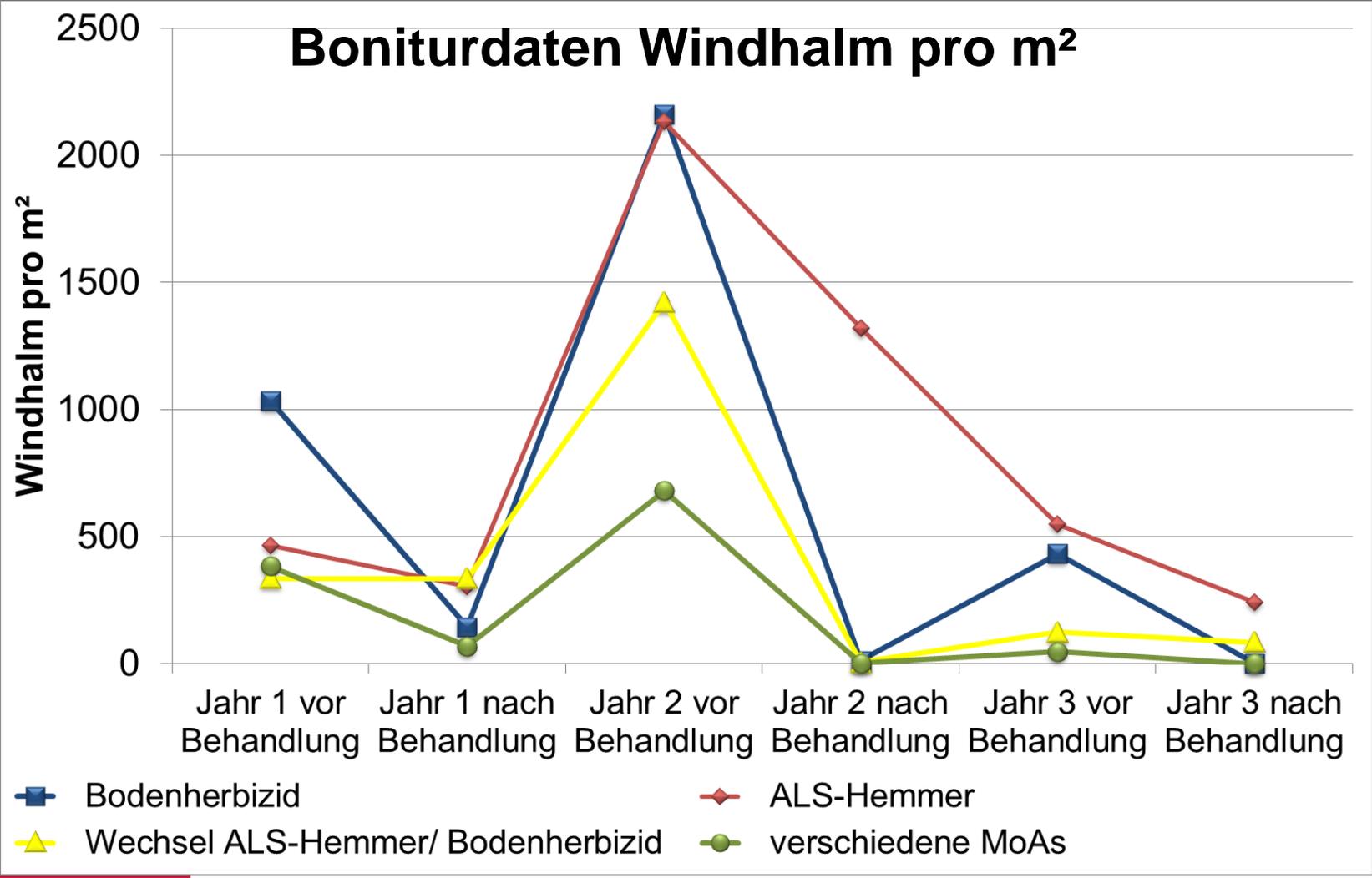
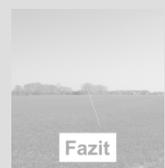
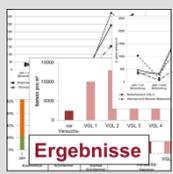


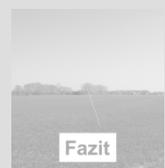
VGL 3:
Wechsel zw.
Bodenherbizid u.
ALS-Hemmer



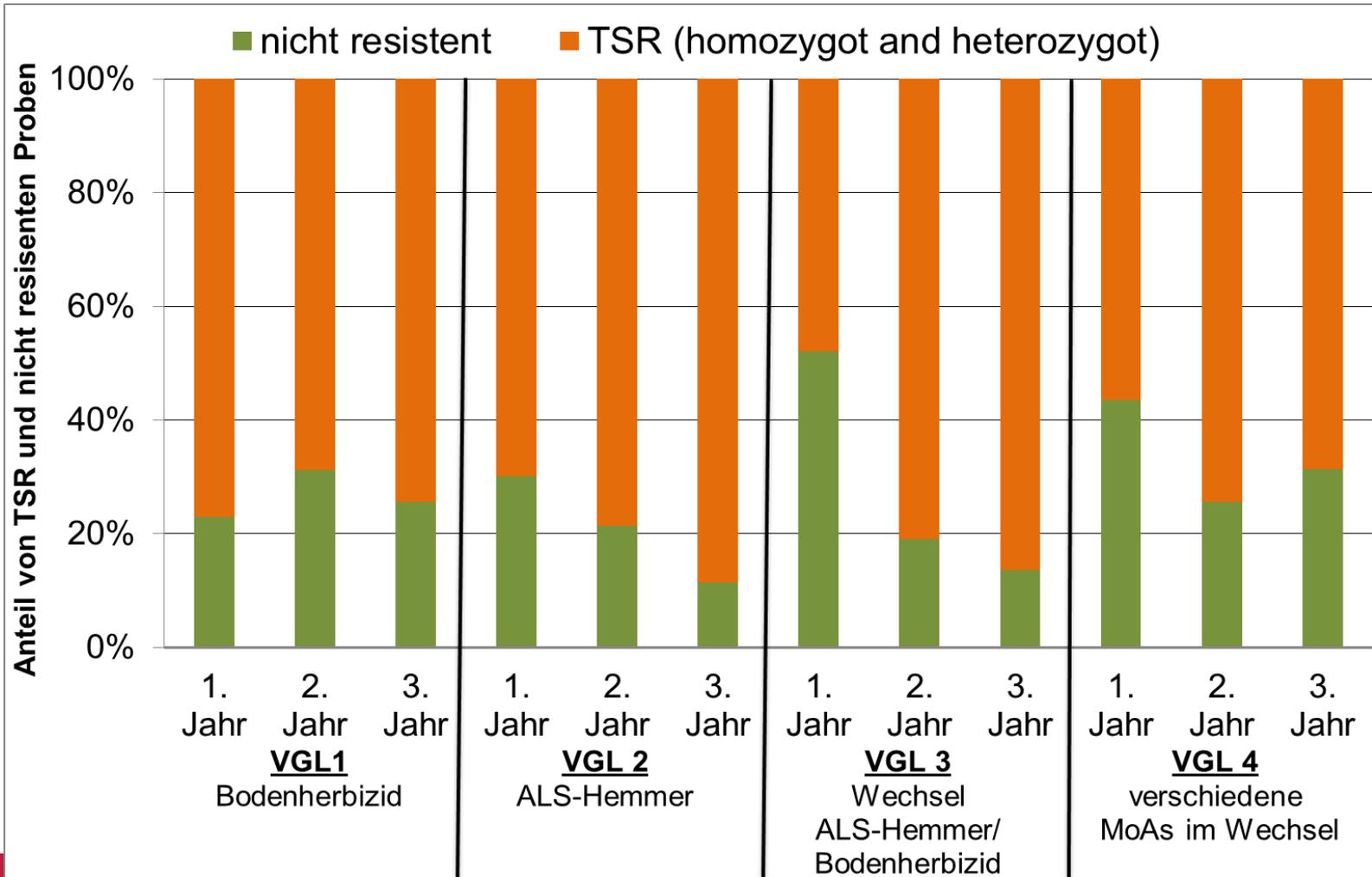
VGL 4:
Herbizide mit
verschiedenen
Wirkorten
im Wechsel

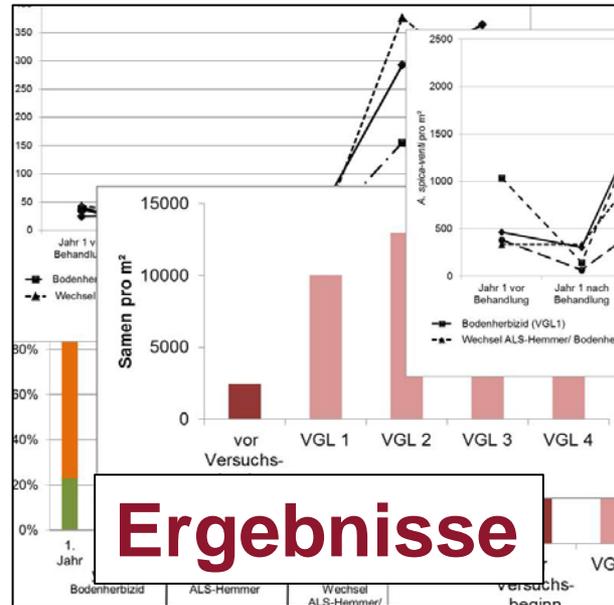






Resistenzdaten





Bonitur - 2. Versuchsabschnitt

vor Behandlung

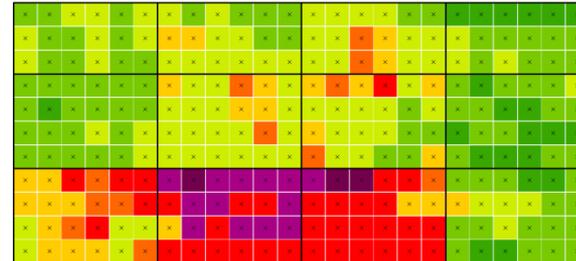
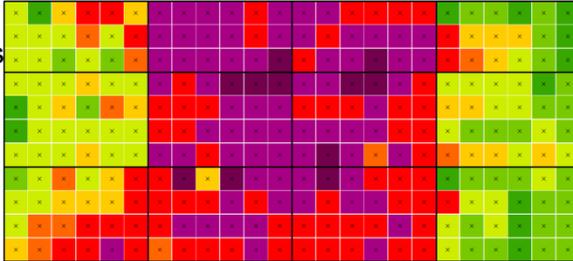
nach Behandlung

VGL 1: Bacara Forte
VGL 2: Husar
VGL 3: Husar (Jahr 1 u. 3) Bacara F. (Jahr 2)
VGL 4: IPU/Axial (Jahr 1 u. 3) Bacara F. / Ralon Super (Jahr 2)

VGL 1: Bacara Forte
VGL 2: Husar
VGL 3: Husar (Jahr 1 u. 3) Bacara F. (Jahr 2)
VGL 4: IPU/Axial (Jahr 1 u. 3) Bacara F. / Ralon Super (Jahr 2)

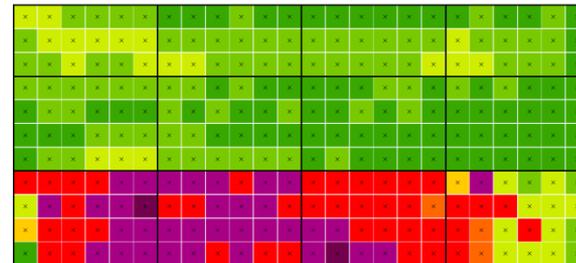
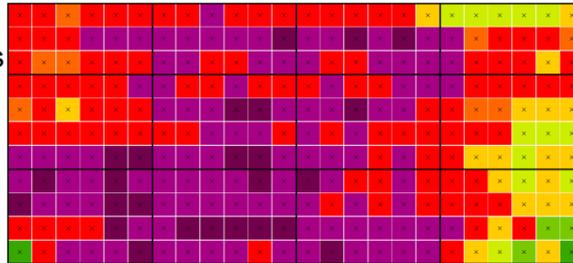
4. Jahr

VGL C: Bacara u. Atlantis
VGL B: Bacara u. Atlantis u. Axial
VGL A: Atlantis



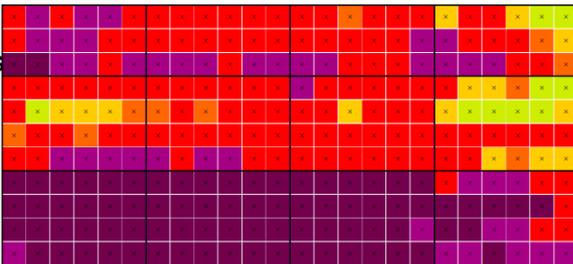
5. Jahr

VGL C: Bacara u. Atlantis
VGL B: Bacara u. Atlantis u. Axial
VGL A: Atlantis

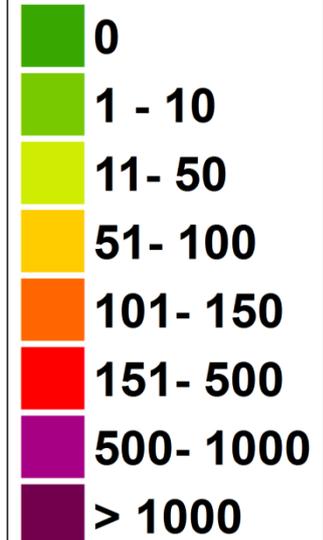


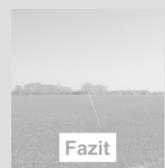
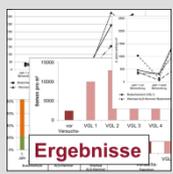
6. Jahr

VGL C: Bacara u. Atlantis
VGL B: Bacara u. Atlantis u. Axial
VGL A: Atlantis



Pflanzen pro m²





1. Versuchsabschnitt

VGL 1
Bodenherbizid

Bacara Forte

VGL 2:
ALS-Hemmer

Husar OD

VGL 3:
ALS-Hemmer/
Bodenherbizid

Husar OD (1. u. 3. Jahr)
Bacara Forte (2. Jahr)

VGL 4:
verschiedene
Wirkmechanismen

IPU/Axial (1. u. 3. Jahr)
*Bacara FORTE/
Ralon Super (2. Jahr)*

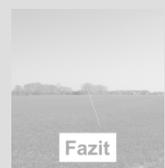
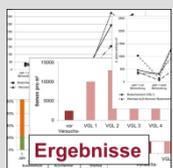
	C/1	C/2	C/3	C/4
	B/1	B/2	B/3	B/4
	A/1	A/2	A/3	A/4

VGL C:
Bodenherbizid
Bacara Forte u. Atlantis

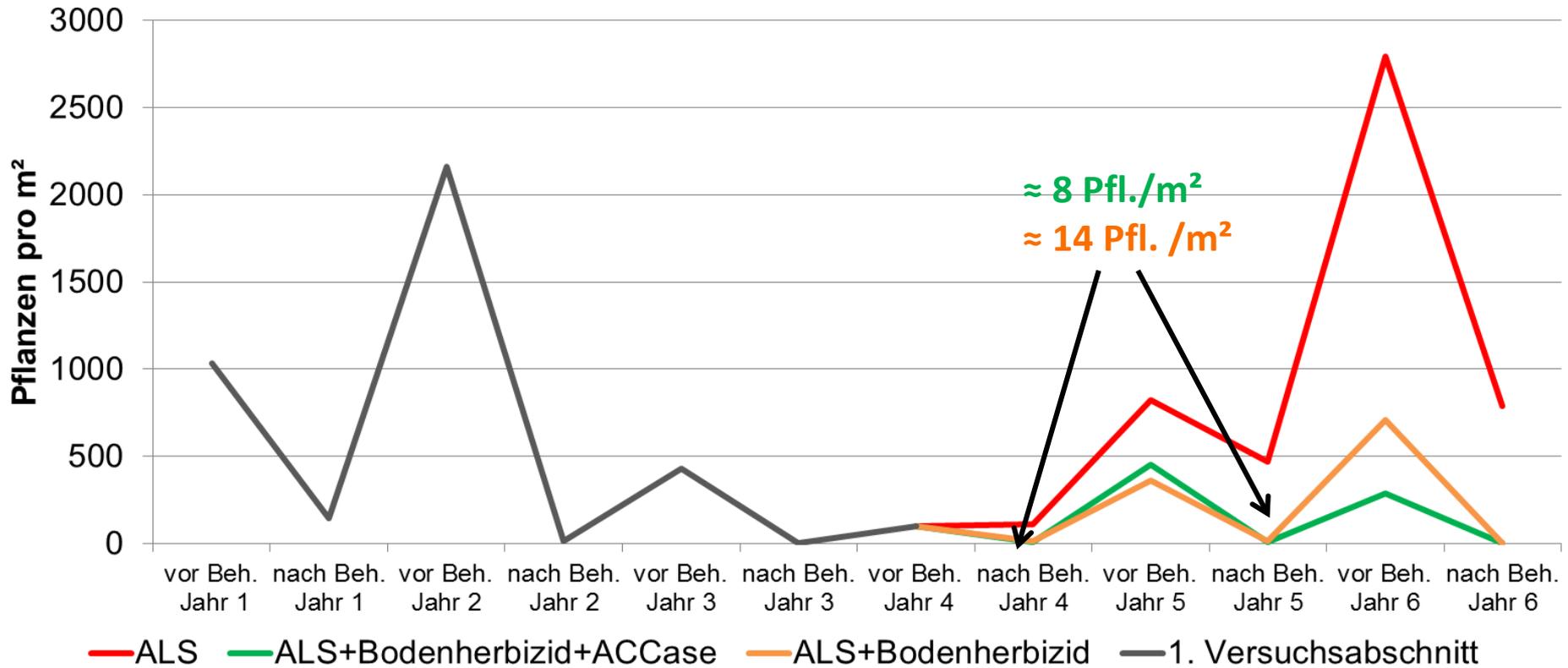
VGL B:
Bodenherbizid + weiteren
Wirkmechanismus
*Bacara Forte u. Atlantis
u. Axial*

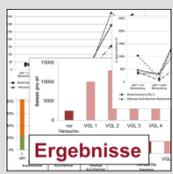
VGL A:
ALS-Hemmer
Atlantis

2. Versuchsabschnitt

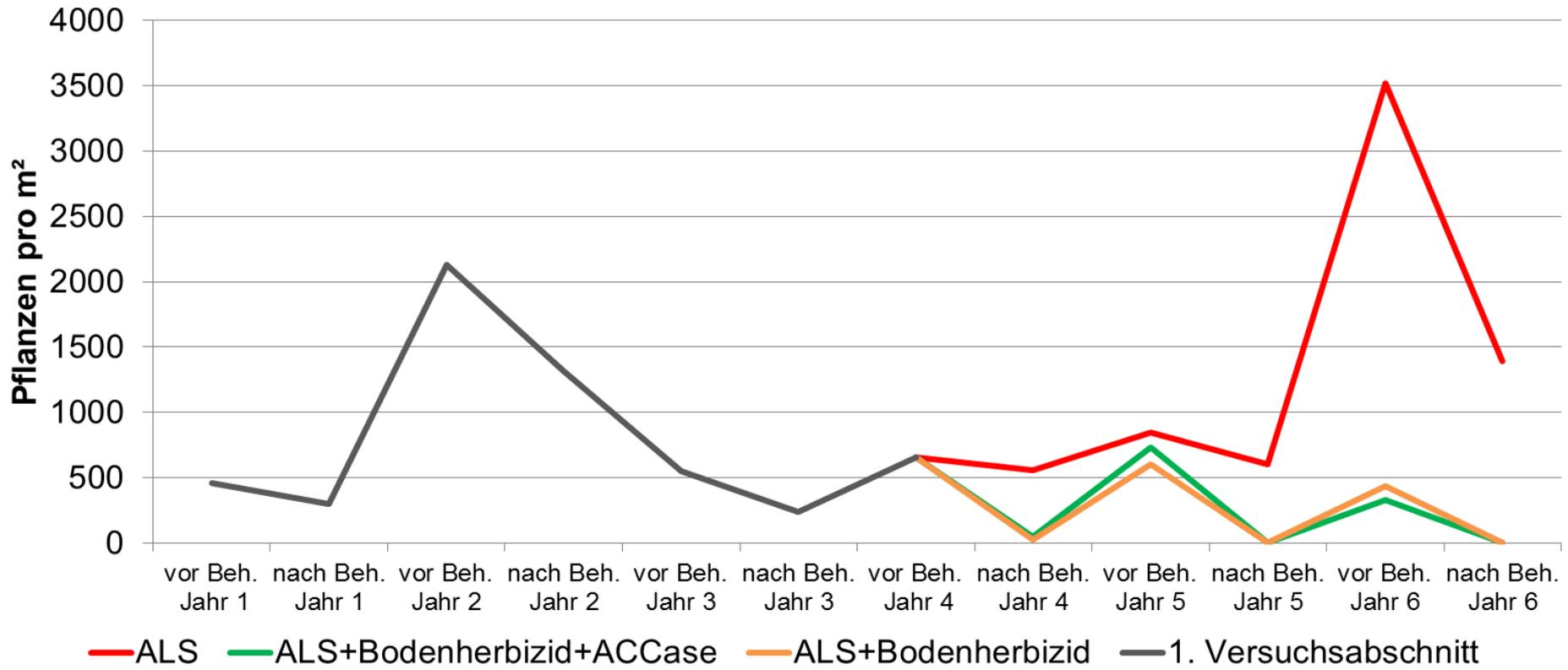


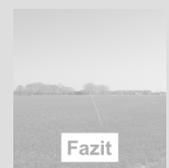
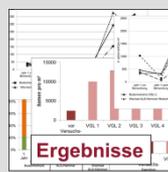
Entwicklung nach 3 Jahren mit Bodenherbizid



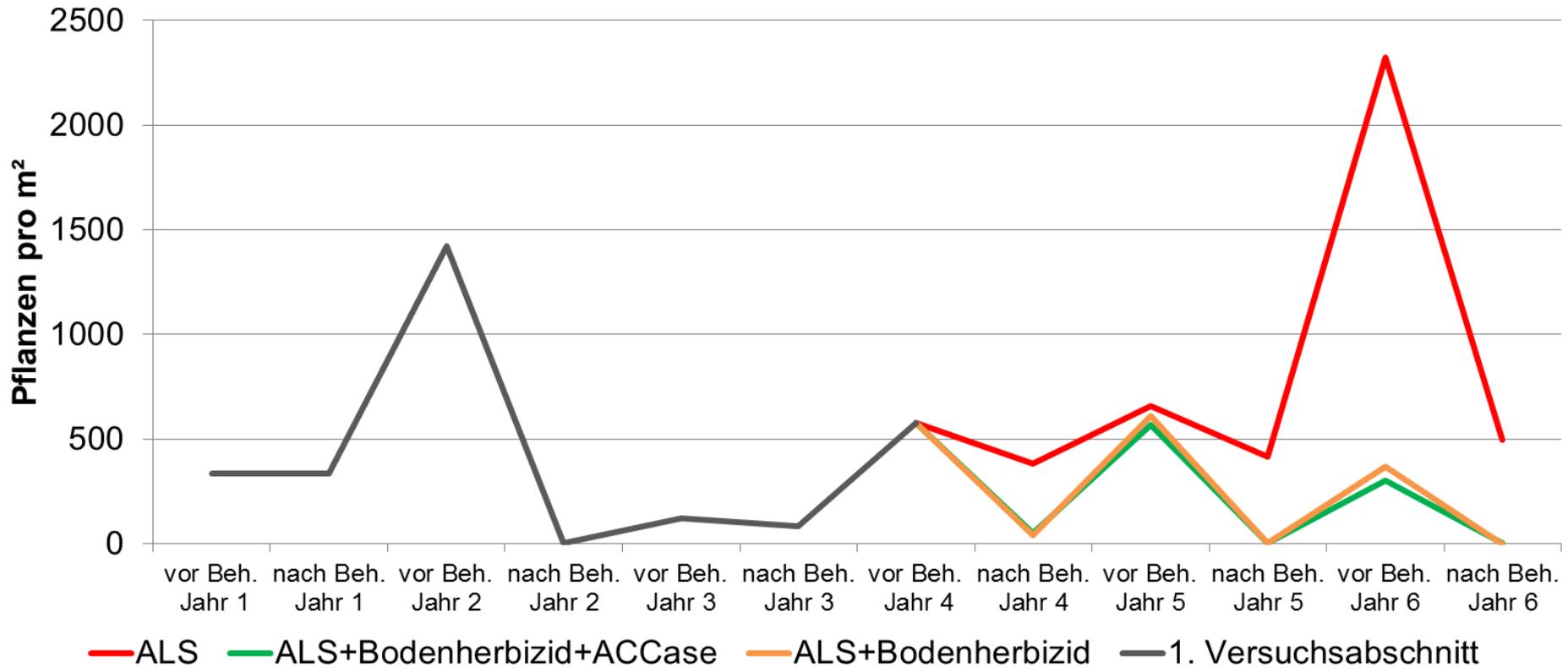


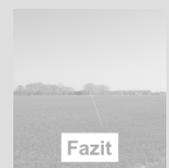
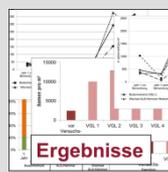
Entwicklung nach 3 Jahren mit ALS-Hemmer



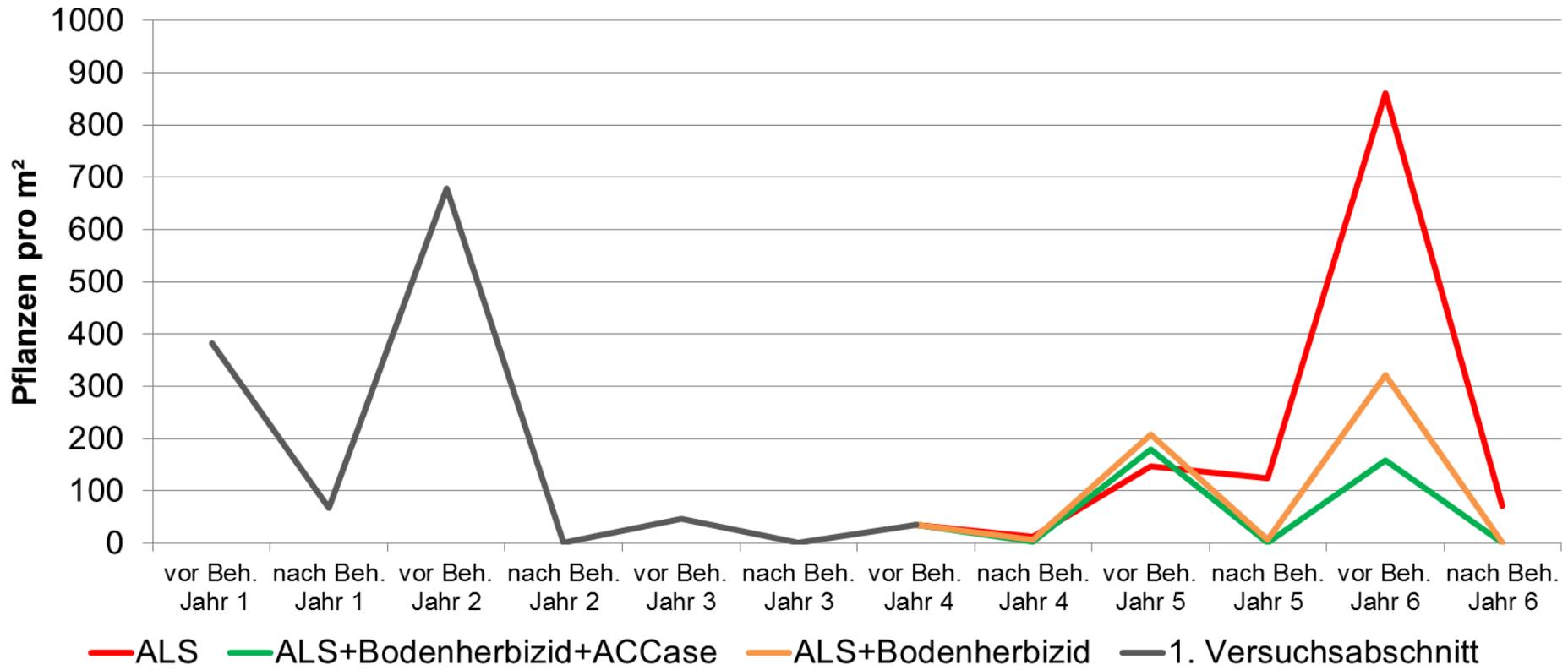


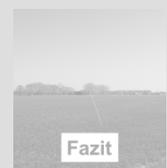
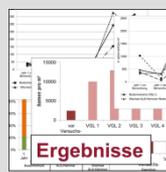
Entwicklung nach 3 Jahren mit ALS-Hemmer/ Bodenherbizid



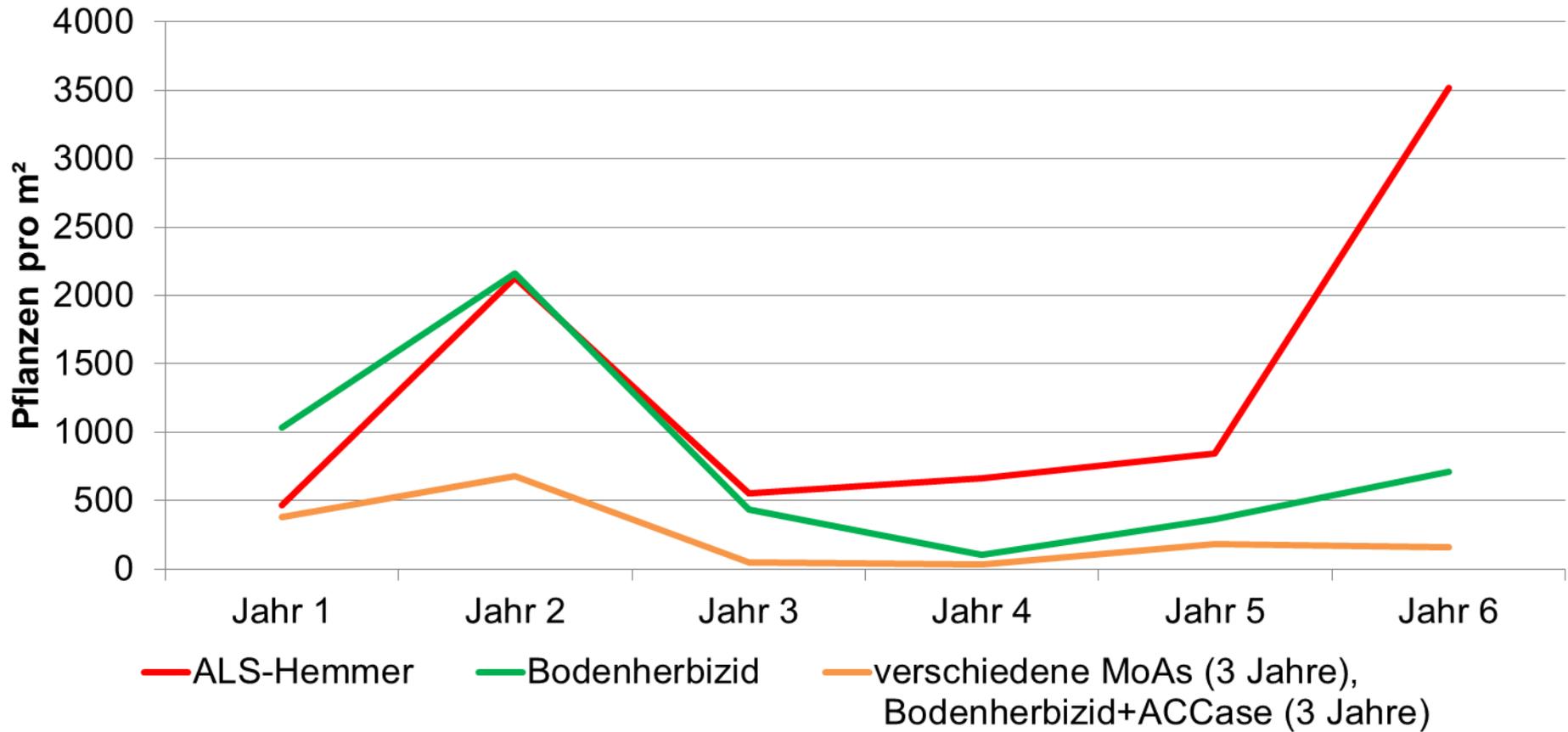


Entwicklung nach 3 Jahren mit verschiedenen MoAs





Vergleich verschiedener Herbizidstrategien

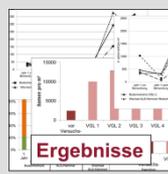




Einleitung



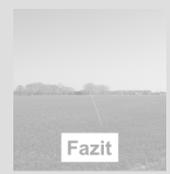
Feldversuch



Ergebnisse



Modell



Fazit

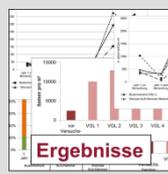




Einleitung



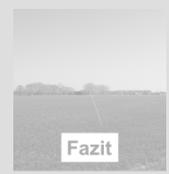
Feldversuch



Ergebnisse

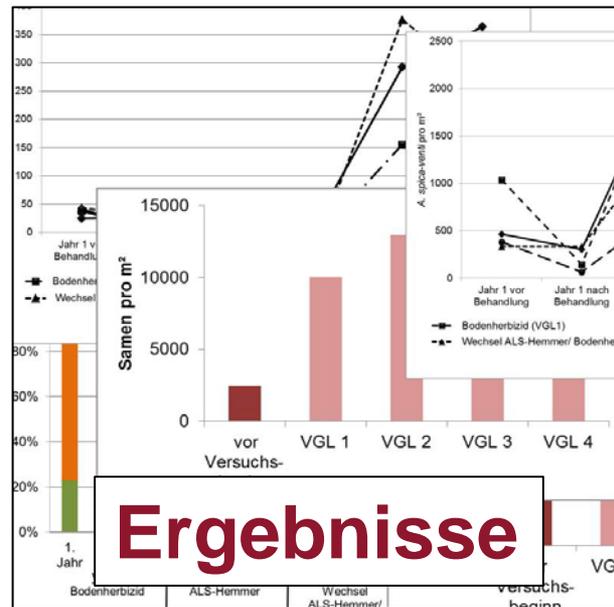


Modell

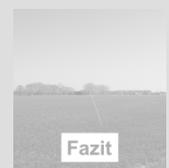
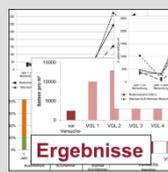


Fazit

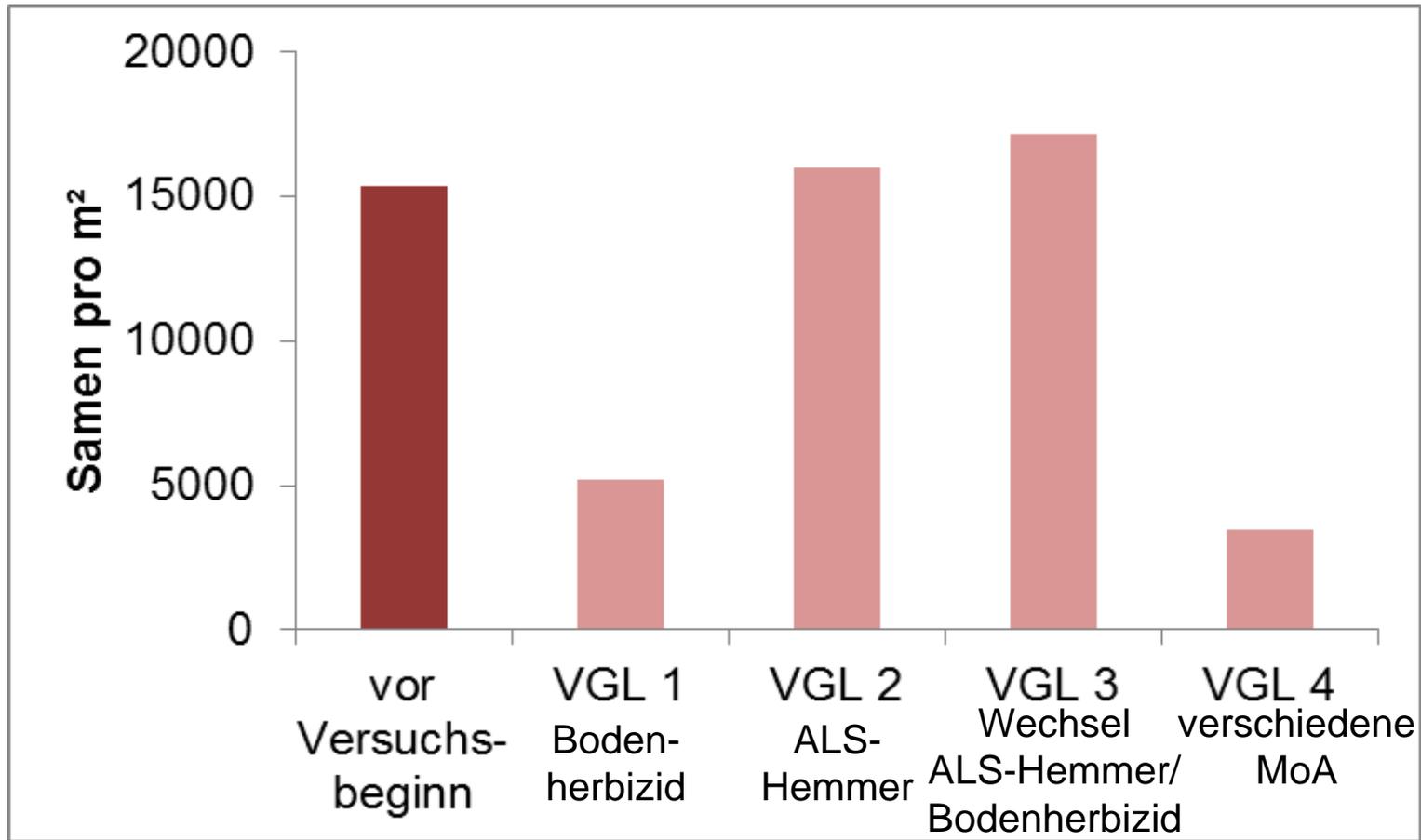


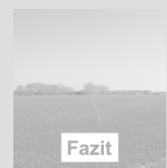
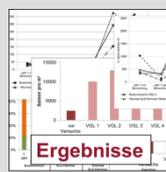


Samenpotentialtest

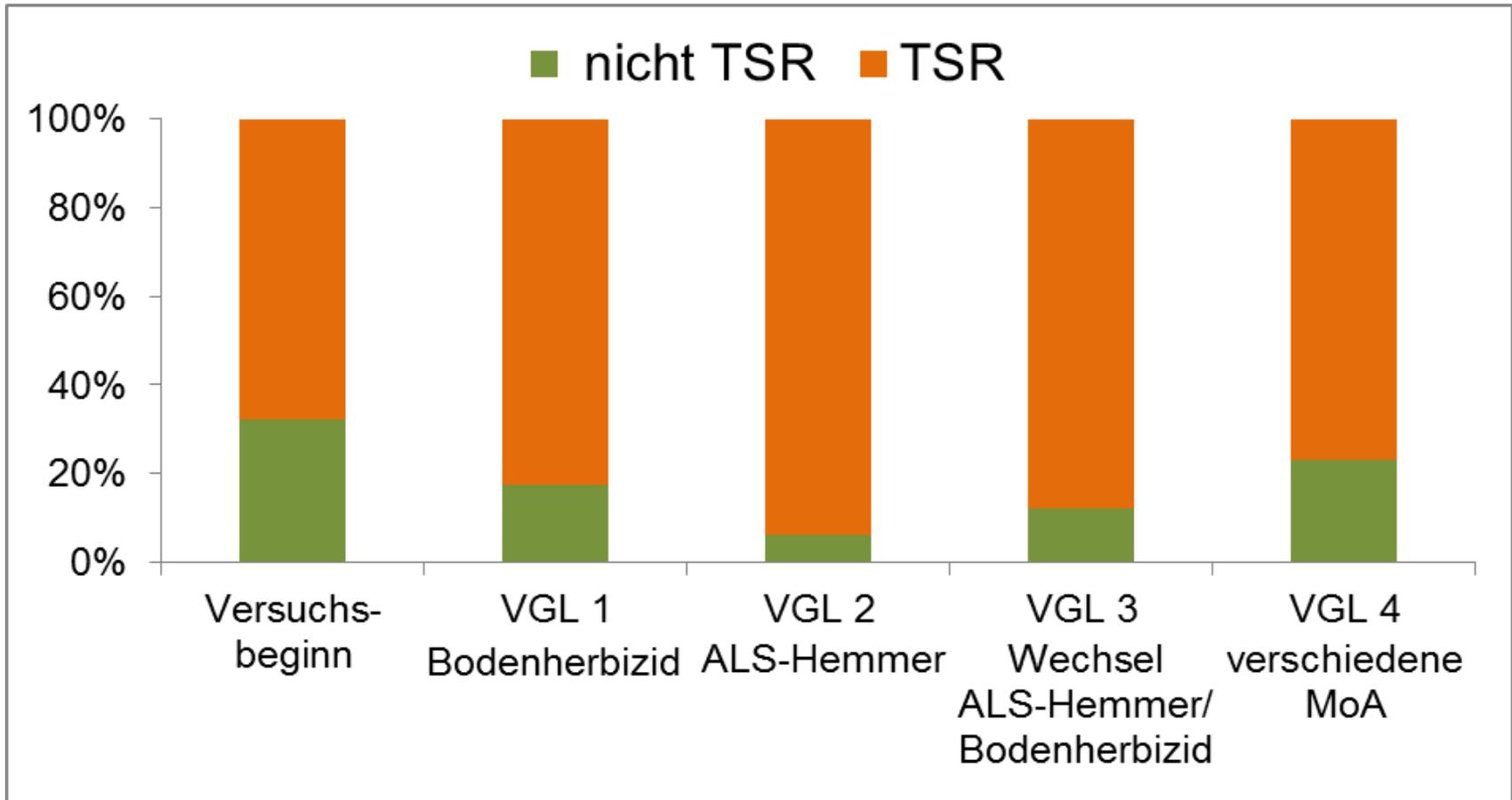


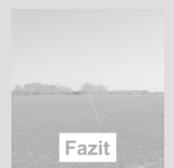
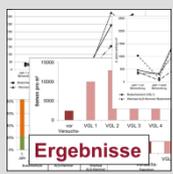
Samenpotential – 1. Versuchsabschnitt



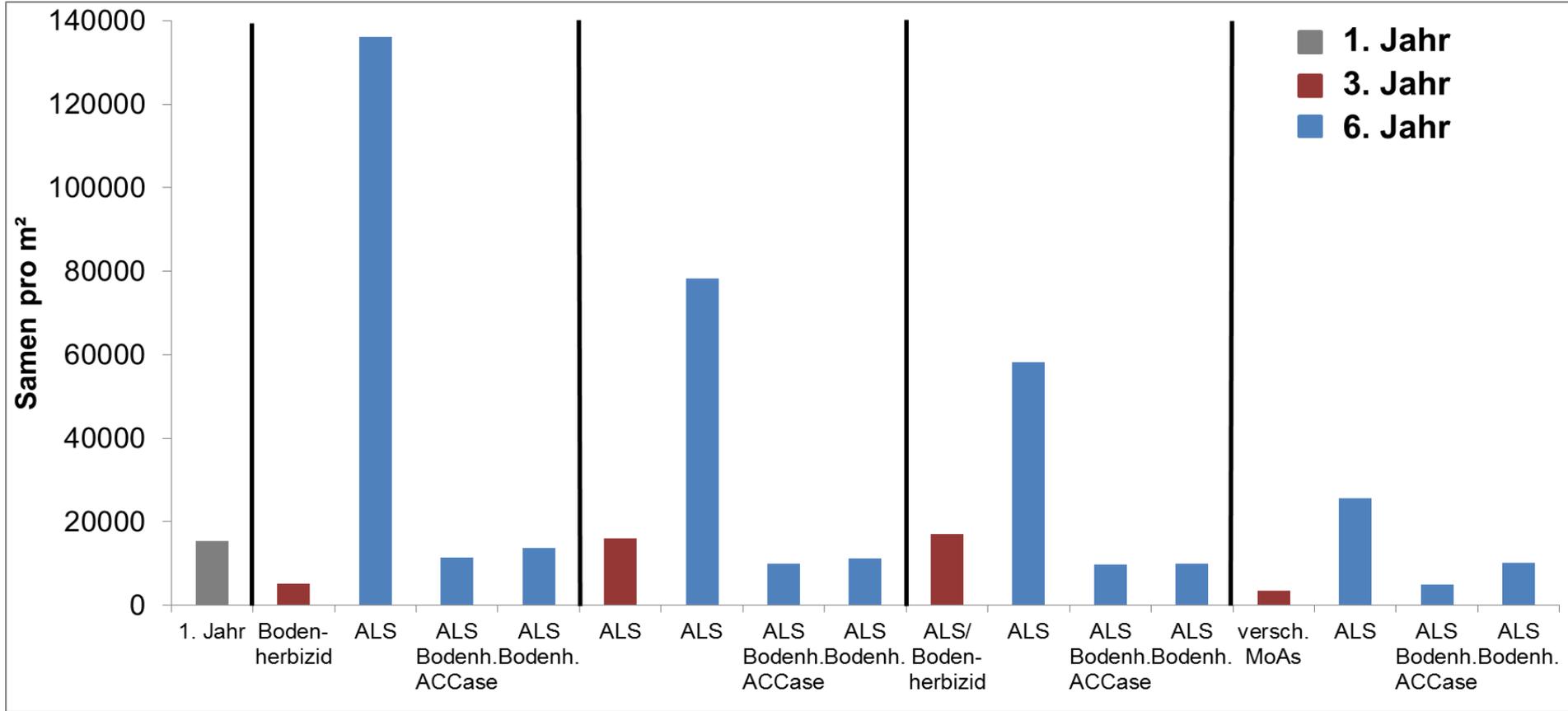


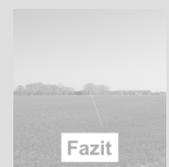
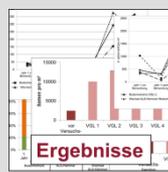
Samenpotential – Anteil resistenter Samen





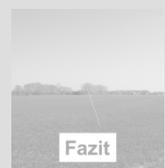
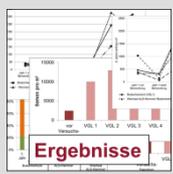
Samenpotential



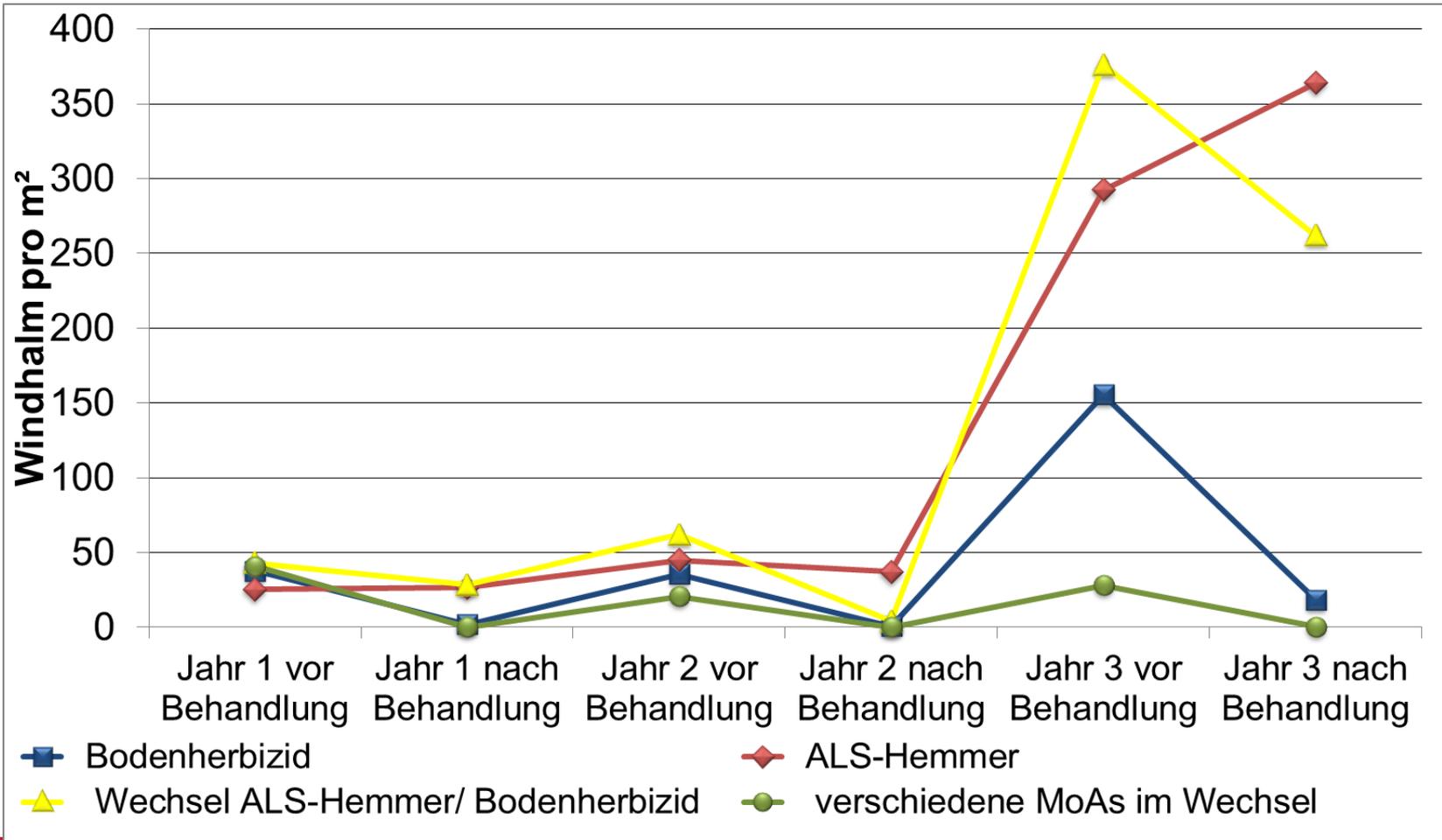


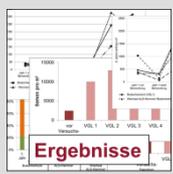
zweiter Standort



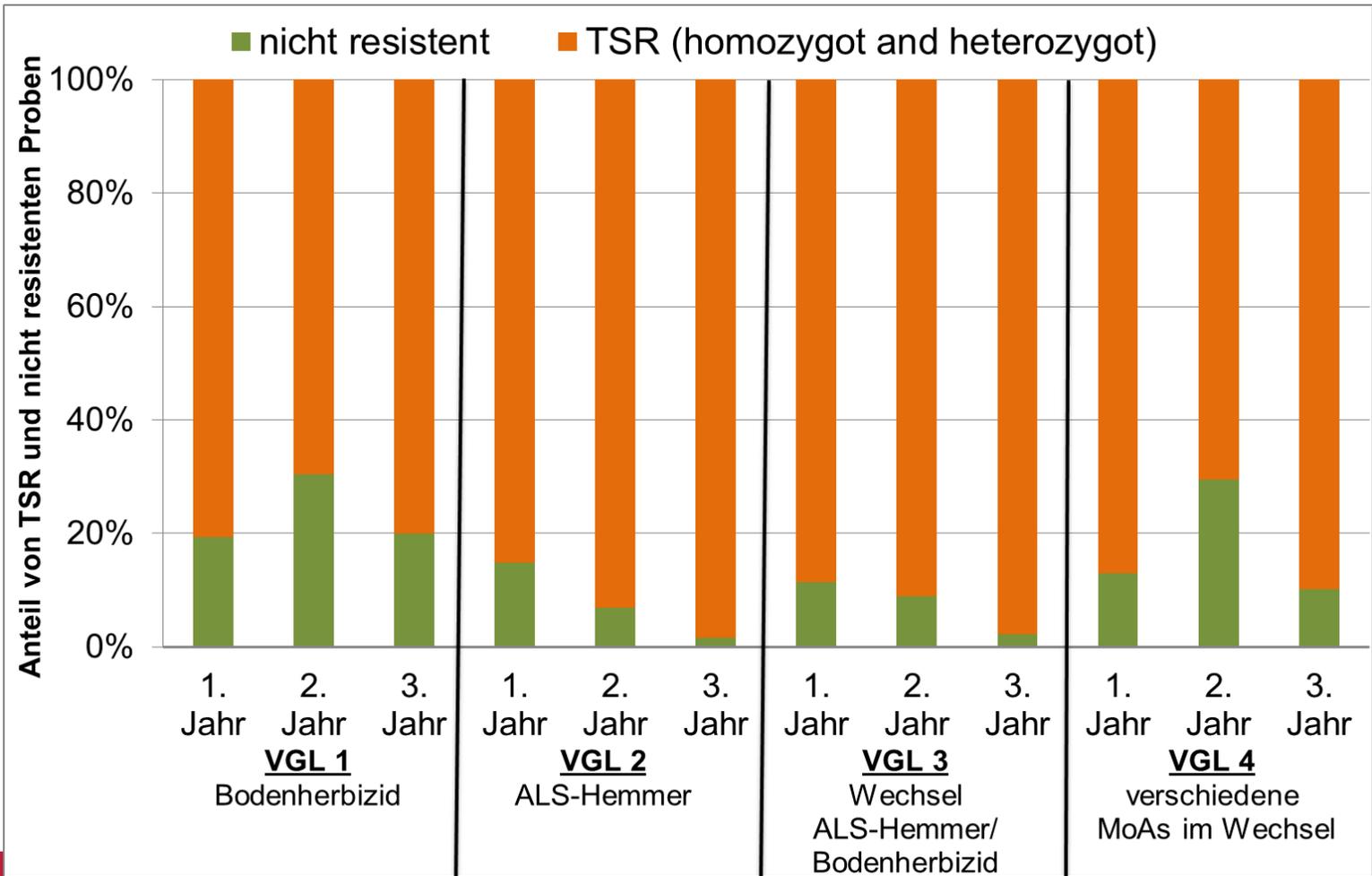


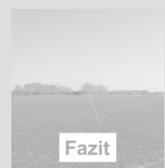
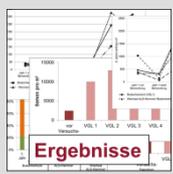
Boniturdaten



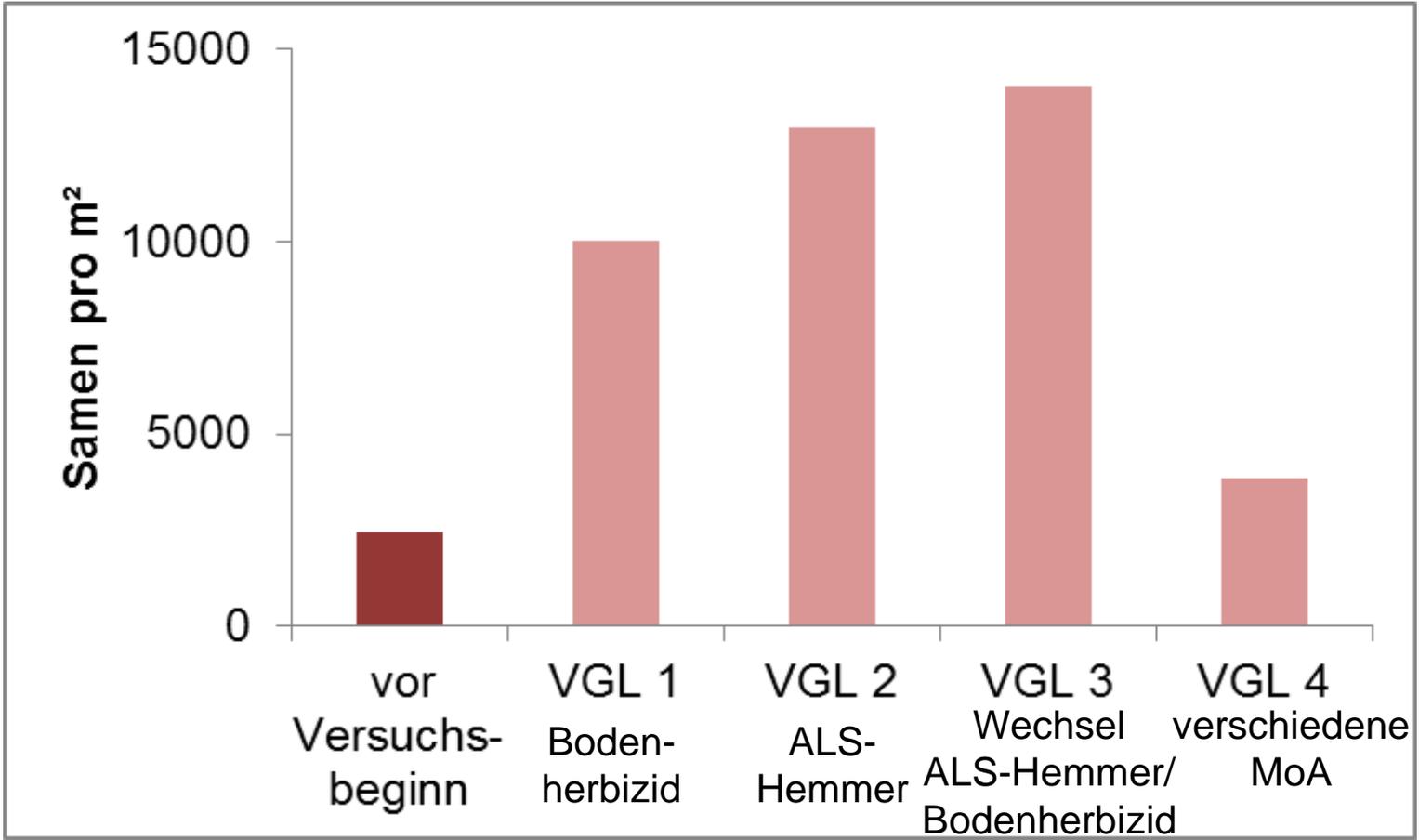


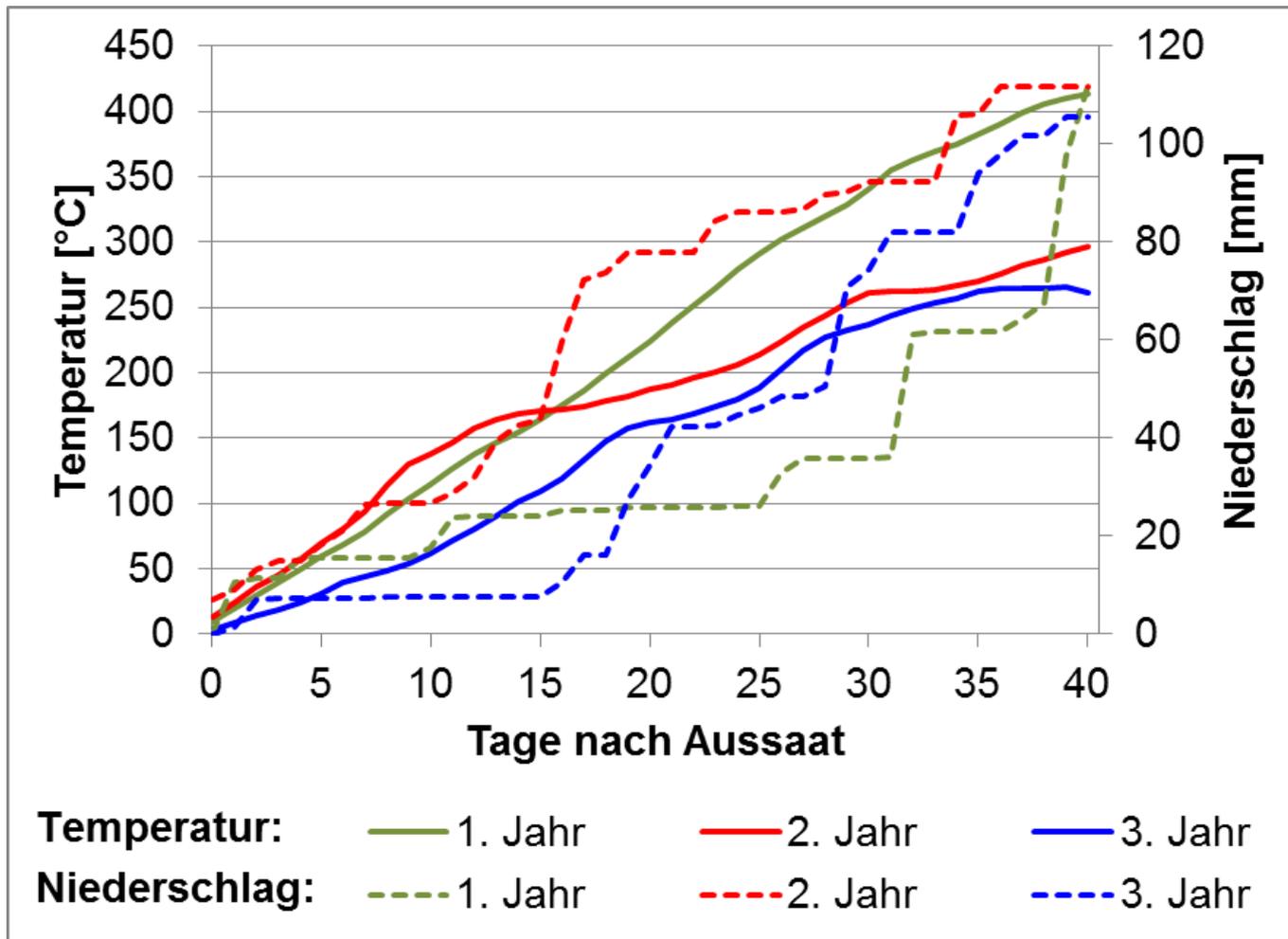
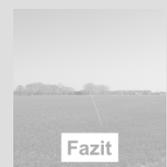
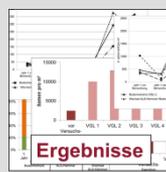
Resistenzdaten

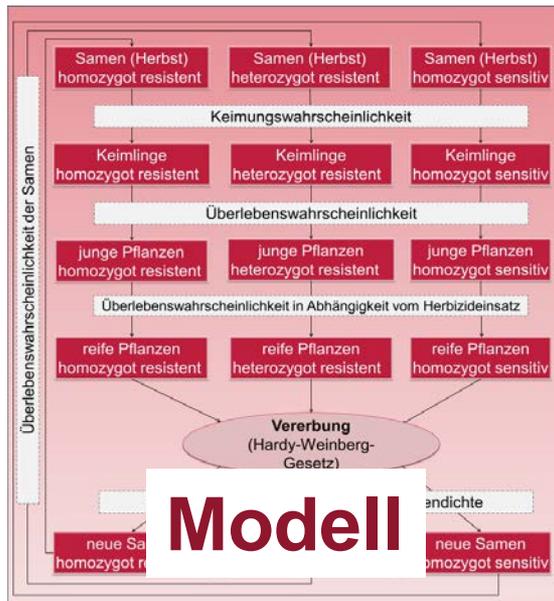


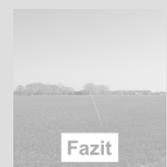
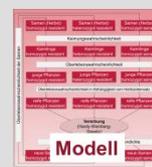


Samenpotential







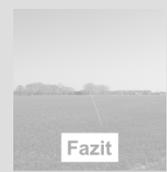
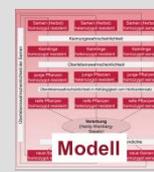


Samenproduktion

mittlere Samenanzahl pro Pflanze 1000 – 12.000
(Zwerger and Ammon, 2002)

bis 16.000 Samen pro Pflanze
(SOUKUP et al., 2006)

10.000 Samen pro Pflanze
(NIEMANN, 1985; PETERSEN, 1992)



Lebensfähigkeit der Samen

1 bis 7 Jahre
(ZEMANEK, 1980)

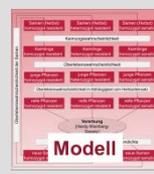
11 Jahre
(Salzmann in KOCH (1964))

meist nicht mehr als 2 Jahre
(ZEMANEK, 1980)

im Durchschnitt 5 Jahre
(NIEMANN, 1985)

maximale Lebensfähigkeit zw. 1 und 4 Jahre
(KOCH et al., 1978)

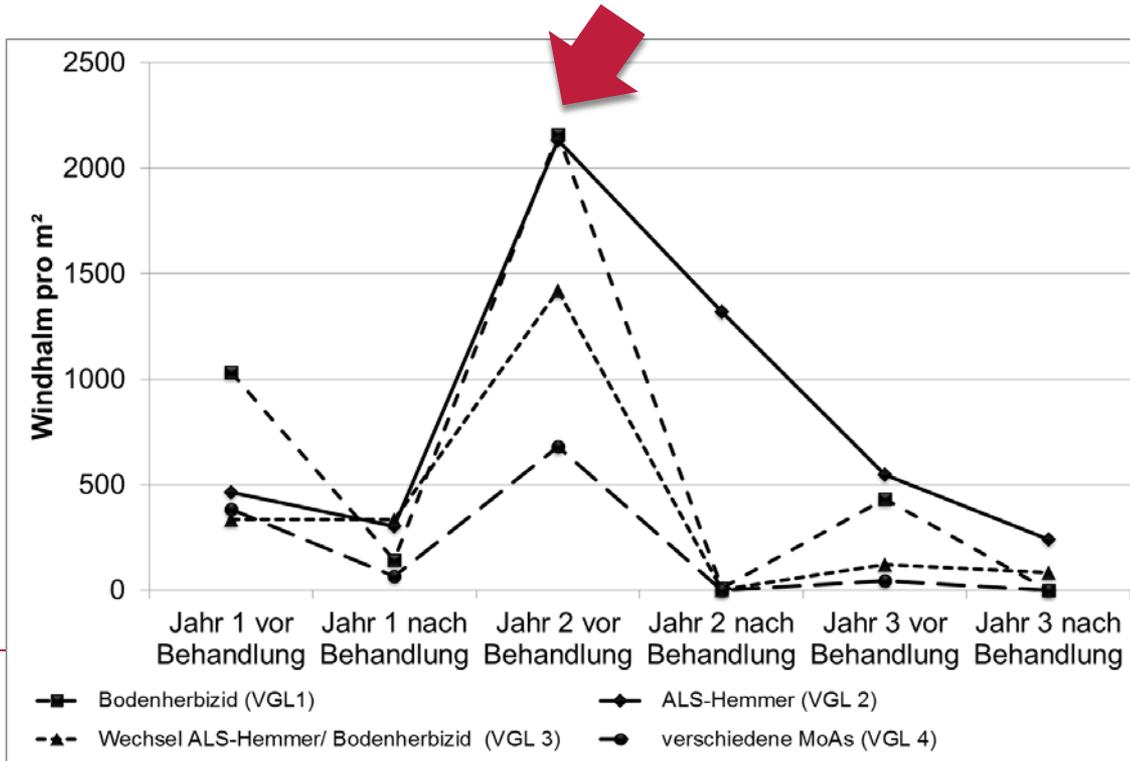


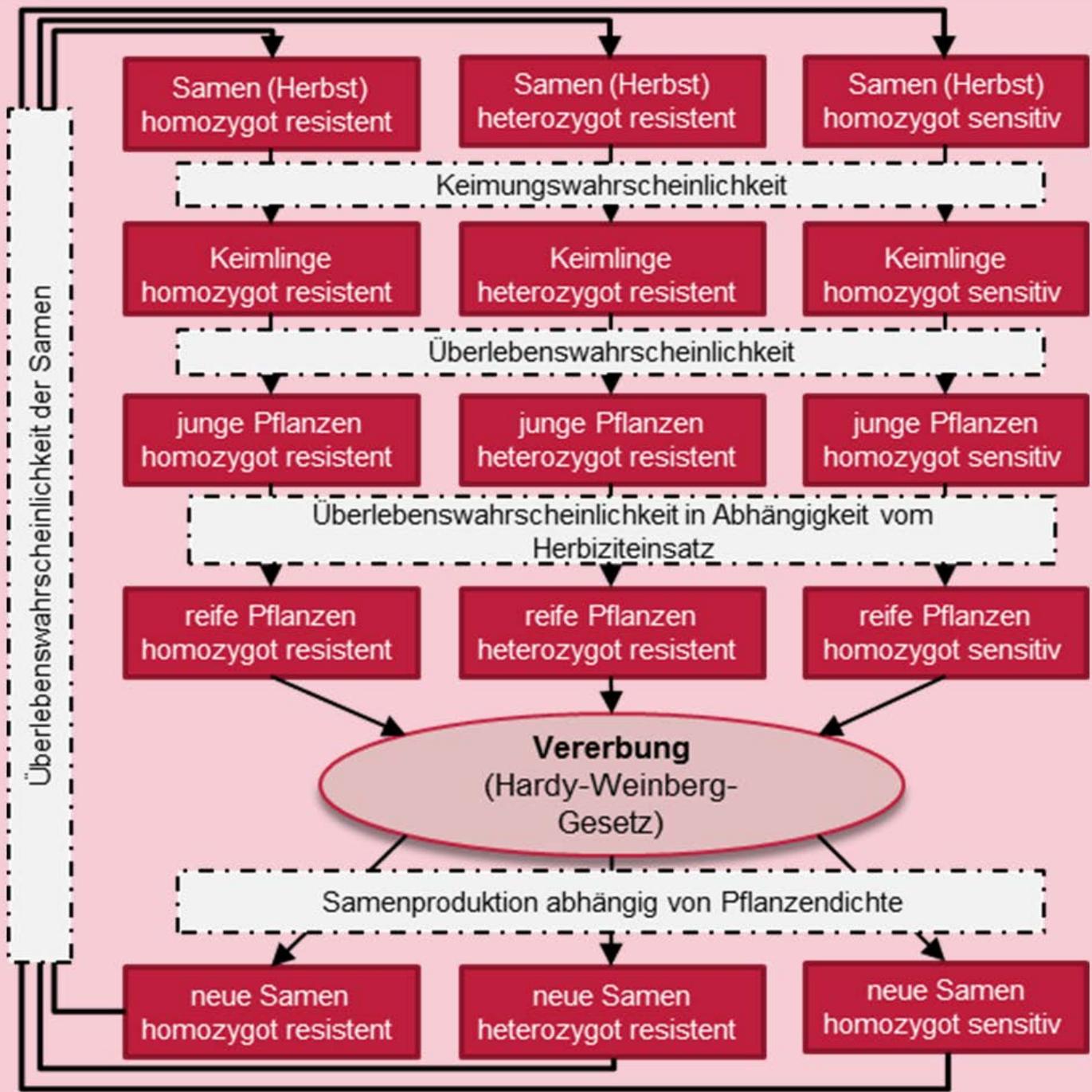


Auflaufrate

frühe Aussaat: 2%
späte Aussaat: 1.3%
(MELANDER, 1993)

zw. 0 und 30%
(AAMISEPP and AVHOLM, 1970)







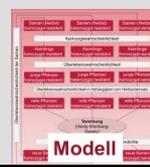
Einleitung



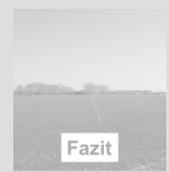
Feldversuch



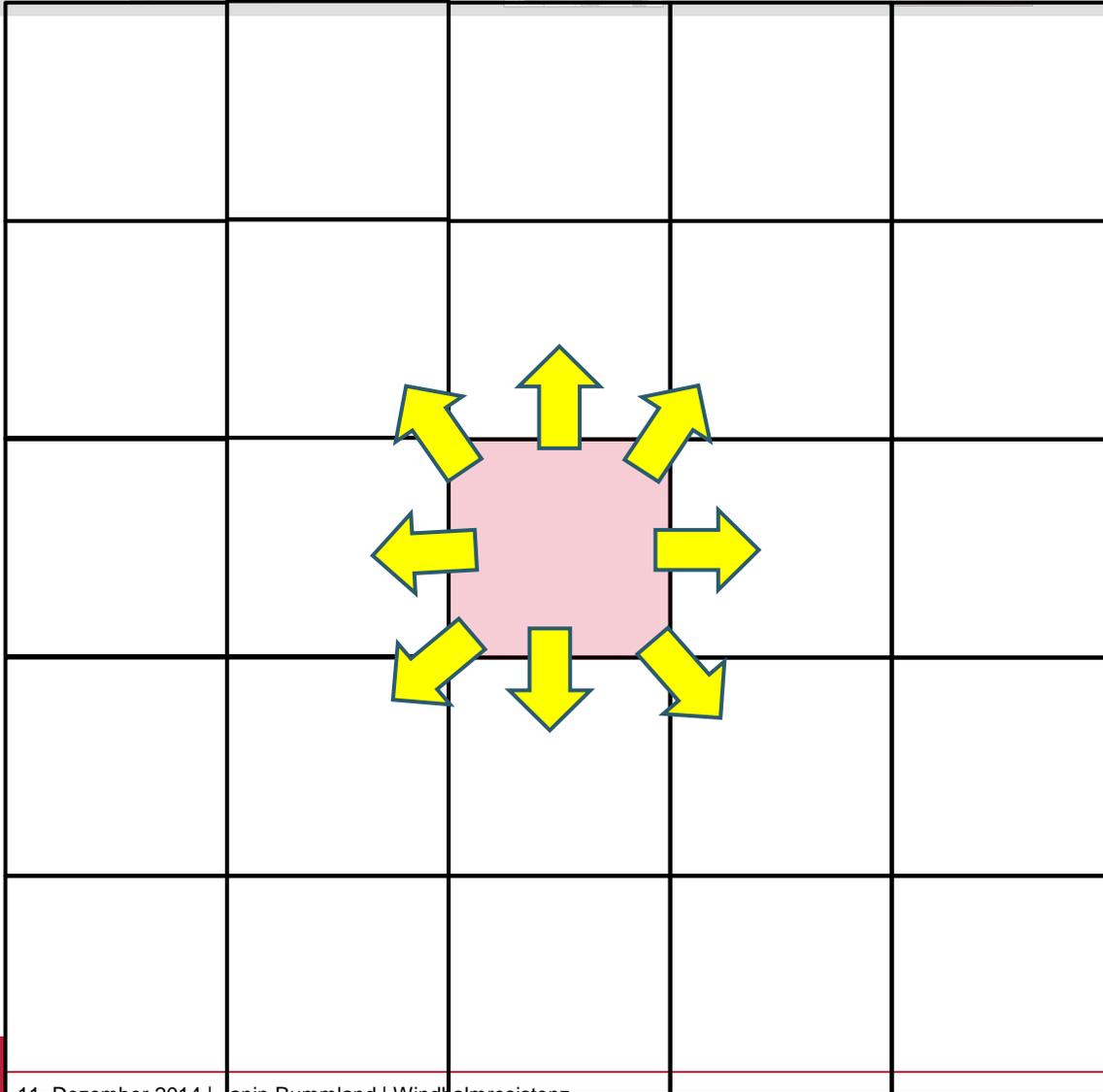
Ergebnisse

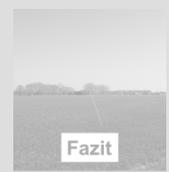
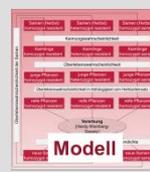


Modell

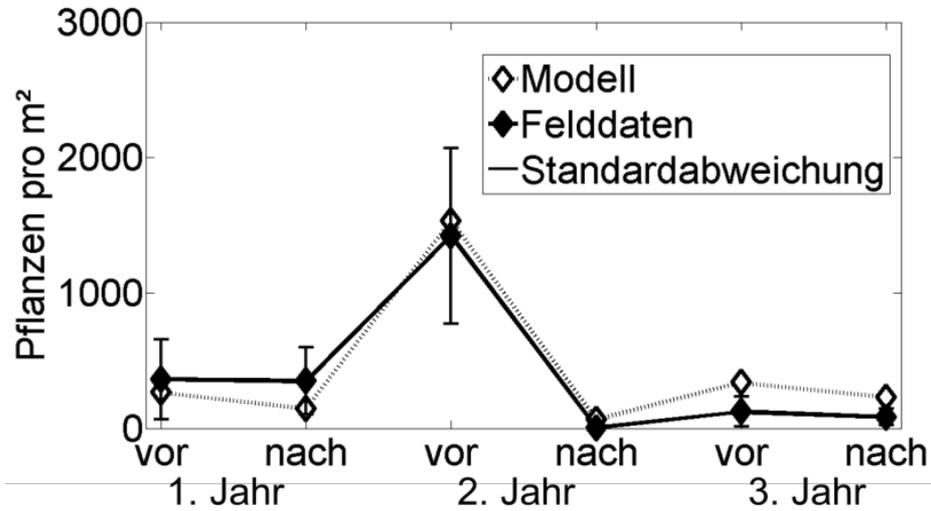


Fazit

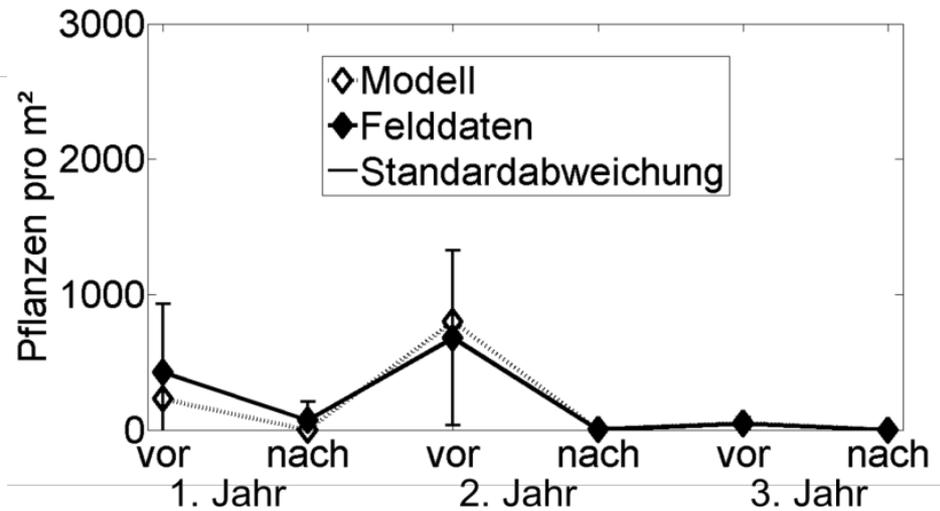


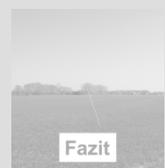
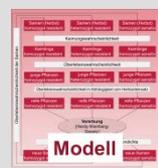


Bautzen, VGL 3, Wechsel von Bodenherbizid/ ALS Hemmer



Bautzen, VGL 4, verschiedene Wirkmechanismen

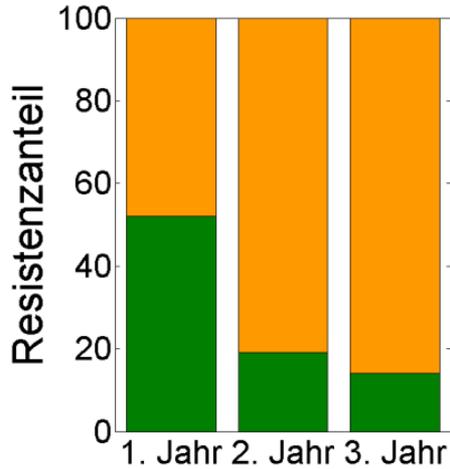
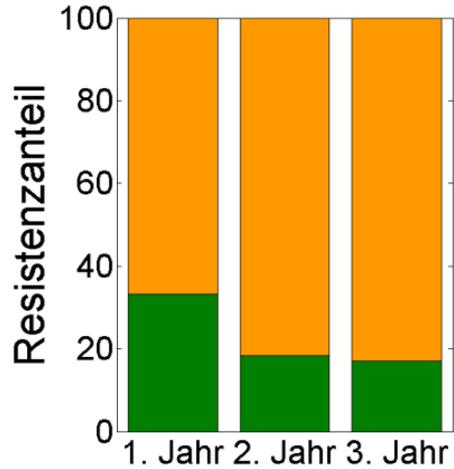




Bautzen, VGL 3, Wechsel von Bodenherbizid/ ALS Hemmer

Modell

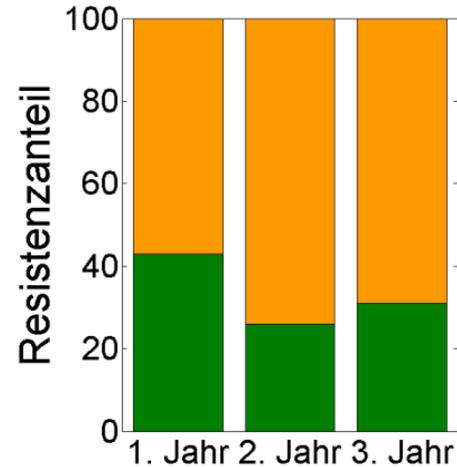
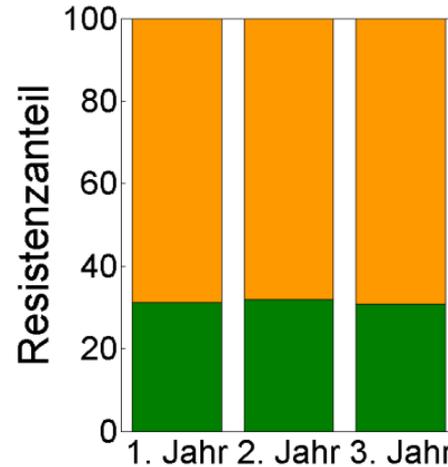
Felddaten

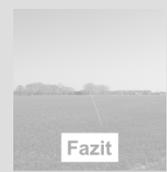
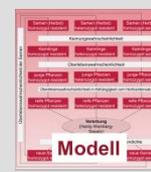


Bautzen, VGL 4, verschiedene Wirkmechanismen

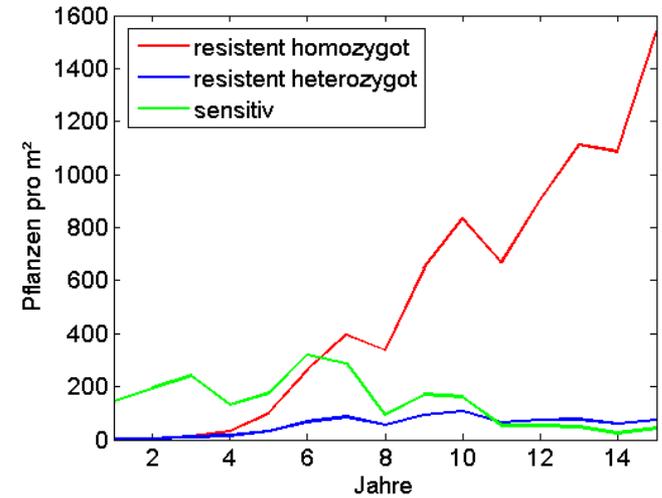
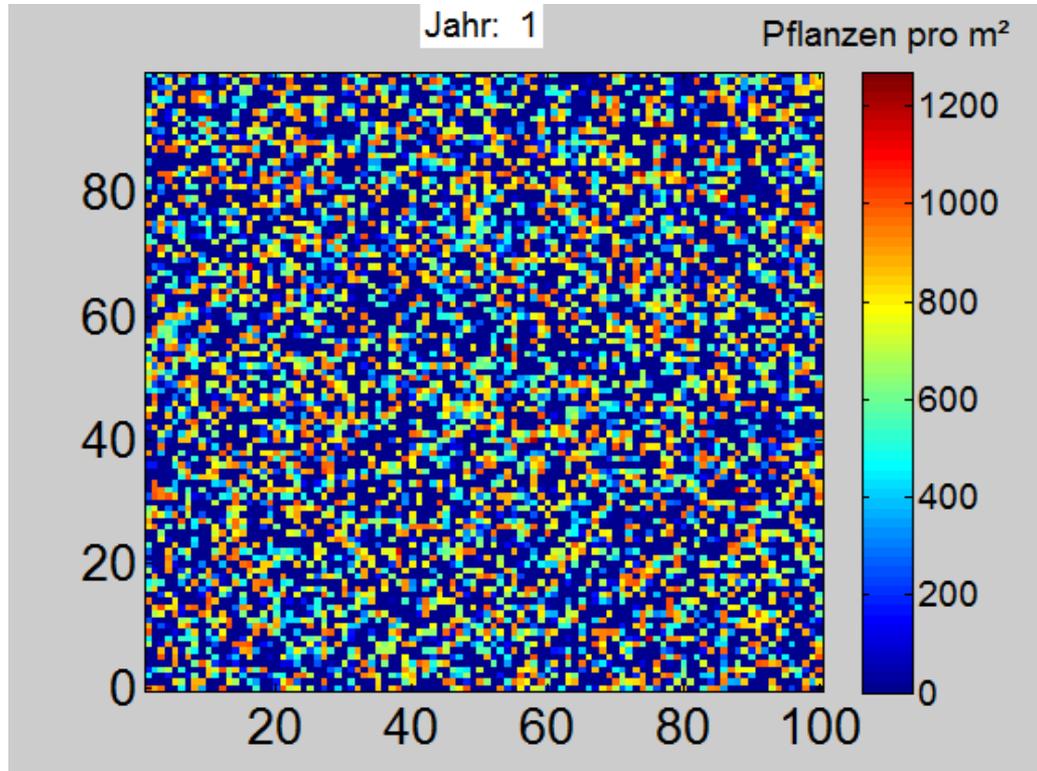
Modell

Felddaten





Szenarien







Fazit-Feldversuch

- Auflaufraten haben großen Einfluss
- intensiver PSM-Einsatz kann eine resistente Population auf einem geringen Level halten
- Rückkehr zum resistenten Wirkstoff führt zur rasanten Erhöhung der Pflanzendichte
- selbst nach 5 Jahren mit sehr guter Unkrautkontrolle noch auflaufende Windhalmpflanzen



Fazit-Modell

- Trend in TSR-Entwicklung kann abgebildet werden
- Vergleich zw. Felddaten und Modell zeigen gute Übereinstimmung

A landscape photograph showing a vast field of golden-brown grass in the foreground. The background features a line of trees and a small building under a bright blue sky with scattered, light-colored clouds. The text "Vielen Dank für ihre Aufmerksamkeit" is overlaid in the center of the image.

Vielen Dank für ihre Aufmerksamkeit



Abteilung
Umweltsystemanalyse

Vielen Dank an



Bayer CropScience