Prof. Dr. habil. Janna Macholdt

Der fachliche Wert von Dauerfeldversuchen

Professur „Allgemeiner Pflanzenbau & Ökologischer Landbau“, Martin-Luther-Universität Halle-Wittenberg

Was sind Dauerfeldversuche? Wofür brauchen wir sie?

Als Dauerfeldversuche (DFV) werden Freiland-Parzellen-Experimente bezeichnet, die statisch angelegt sind und mehr als 20 Jahre unverändert betrieben werden.

- **Wertvolle Forschungsbasis** → Daten kaum reproduzierbar

- **System „Klima-Boden-Pflanze-Management“** besser verstehen

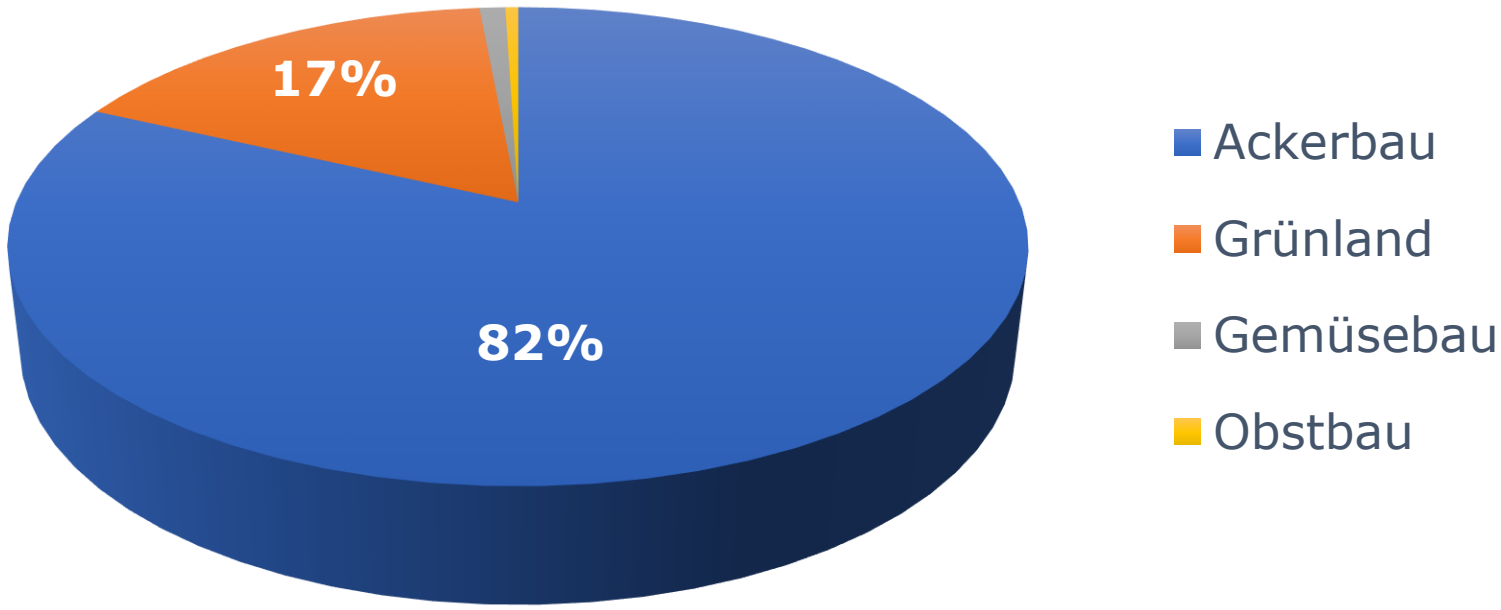
- **Langfristigen Einfluss** von Umwelt & Bewirtschaftung einschätzen

Die ältesten & bekanntesten Dauerfeldversuche der Welt

1. Broadbalk (Rothamsted, Großbritannien) → 1843
2. Park Grass (Rothamsted, Großbritannien) → 1856
3. Morrow Plots (University of Illinois, USA) → 1876
4. Ewiger Roggen (MLU Halle, Deutschland) → 1878
5. Sanborn Field (University of Missouri, USA) → 1888
6. Askov LTE (Aarhus University, Dänemark) → 1894

Weltweit gibt es heute noch über 600 DFV, etwa 25 davon sind älter als 100 Jahre.

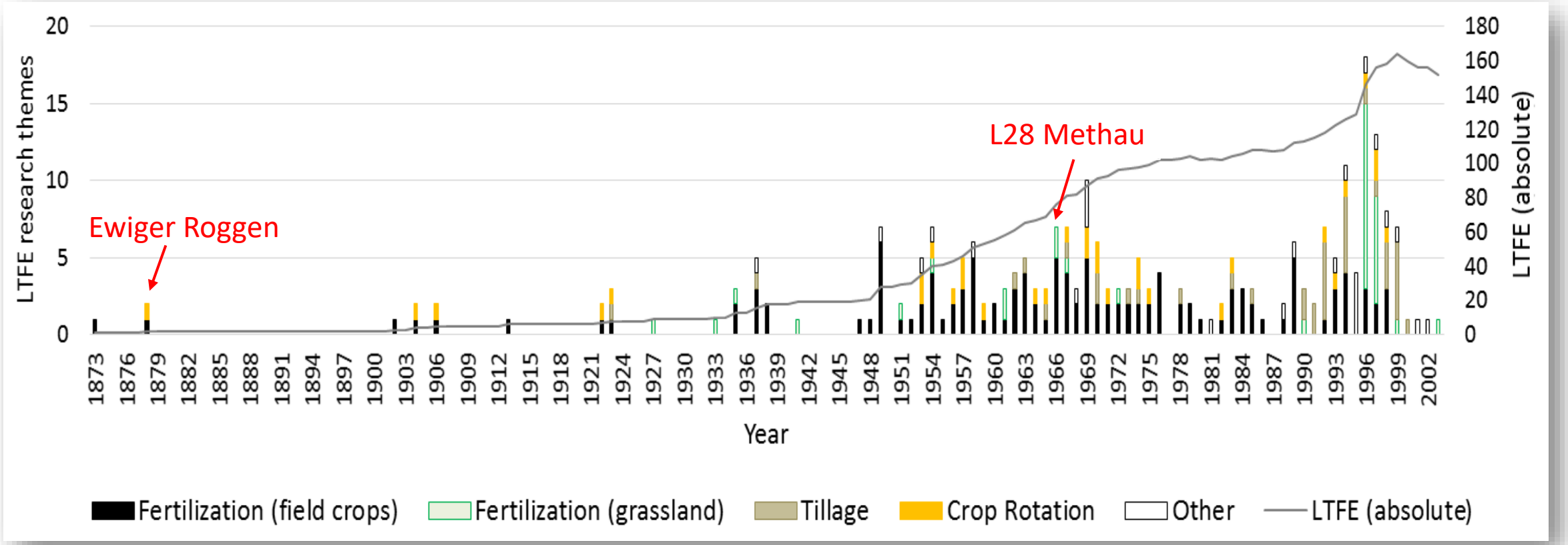
Dauerfeldversuche in Deutschland: Klassifizierung



205 DFV identifiziert – davon ca. 2/3 aktiv & 1/3 beendet

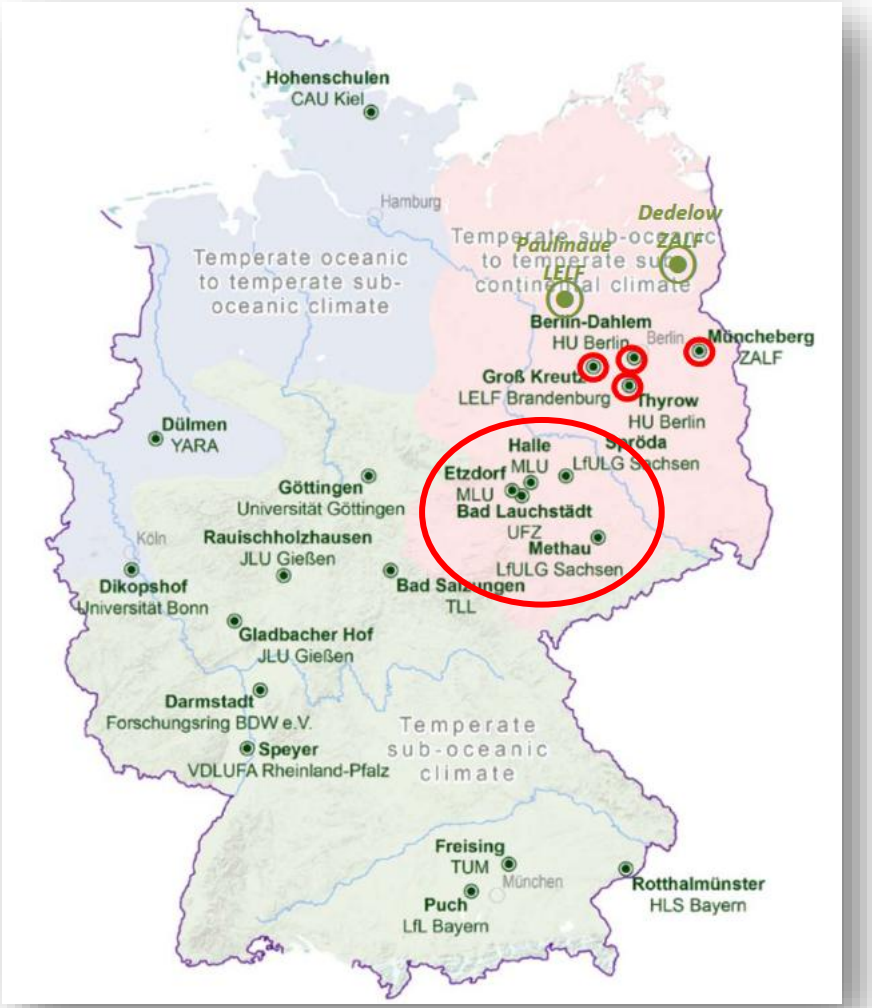
https://soil.copernicus.org/articles/6/579/2020/soil-6-579-2020.pdf

Wann & wofür wurden Dauerfeldversuche bisher angelegt?



https://soil.copernicus.org/articles/6/579/2020/soil-6-579-2020.pdf

Spezifika von Dauerfeldversuchen: Was macht sie aus?



→ Langfristige Verfügbarkeit & statisches Design

→ Kontrollierte Differenzierung der Bewirtschaftung

→ Repräsentanz „Boden-Klima-Raum“

→ Repräsentanz „Landwirtschaftliche Nutzung“

89 % der Ackerbau-DFV liegen in trockenen Regionen

Table 2. Climatic water balance of the growing season (1 May to 31 October) (CWBg) classification of arable land in Germany and the number and share of the different LTFE types in each CWBg class.

CWBg class	Range [mm yr^{-1}]	Agricultural area (arable)		LTFEs total (arable land) ($n = 169$)		Fertilization LTFEs* ($n = 124$)		Tillage LTFEs* ($n = 38$)		Crop rotation LTFEs* ($n = 32$)	
		Area [ha]	Share [%]	Number	Share [%]	Number	Share [%]	Number	Share [%]	Number	Share [%]
1	< -150	3 135 676	23	66	39	49	40	13	34	13	41
2	-150 to < -50	4 473 111	33	49	29	39	31	12	32	6	19
3	-50 to < 50	4 468 852	33	35	21	21	17	11	29	3	9
4	50 to < 150	926 798	7	10	6	10	8	1	3	4	13
5	150 to < 300	492 110	4	9	5	5	4	1	3	6	19
6	300 to < 500	0	0	0	0	0	0	0	0	0	0
7	> 500	0	0	0	0	0	0	0	0	0	0

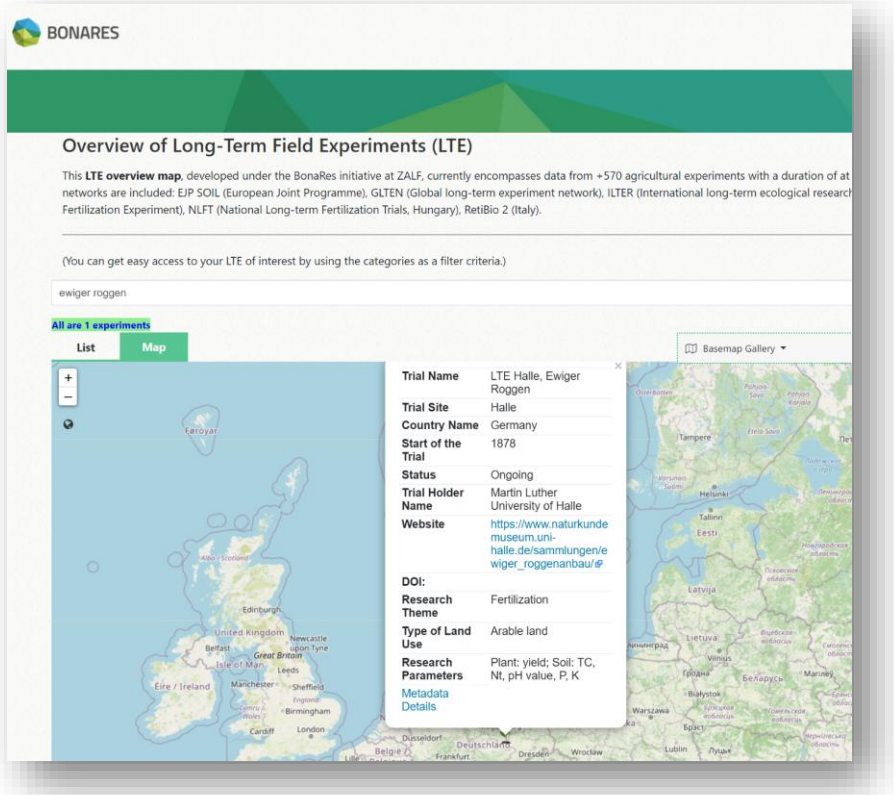
* Multiple nominations possible.

https://soil.copernicus.org/articles/6/579/2020/soil-6-579-2020.pdf

BonaRes: Boden als nachhaltige Ressource für die Bioökonomie

BONARES ist BMBF-Fördermaße „Nationale Forschungsstrategie Bioökonomie 2030“

Groß angelegte Verbundforschung in Deutschland, DFV als wichtige Informationsquelle



→ **Online-Übersichtskarte** inkl. Metainformationen

→ **DFV-Steckbriefe** inkl. Versuchsbeschreibungen

→ **Data Repository** stellt Daten öffentlich bereit

Link zur Übersichtskarte: https://lte.bonares.de/

Overview of Long-Term Field Experiments (LTE)

This **LTE overview map**, developed under the BonaRes initiative at ZALF, currently encompasses data from +570 agricultural experiments with a duration of at least a minimum of 20 years. The following networks are included: EJP SOIL (European Joint Programme), GLTEN (Global long-term experiment network), ILTER (International long-term ecological research), IOSDV (International Organic Nitrogen Fertilization Experiment), NLFT (National Long-term Fertilization Trials, Hungary), RetiBio 2 (Italy).

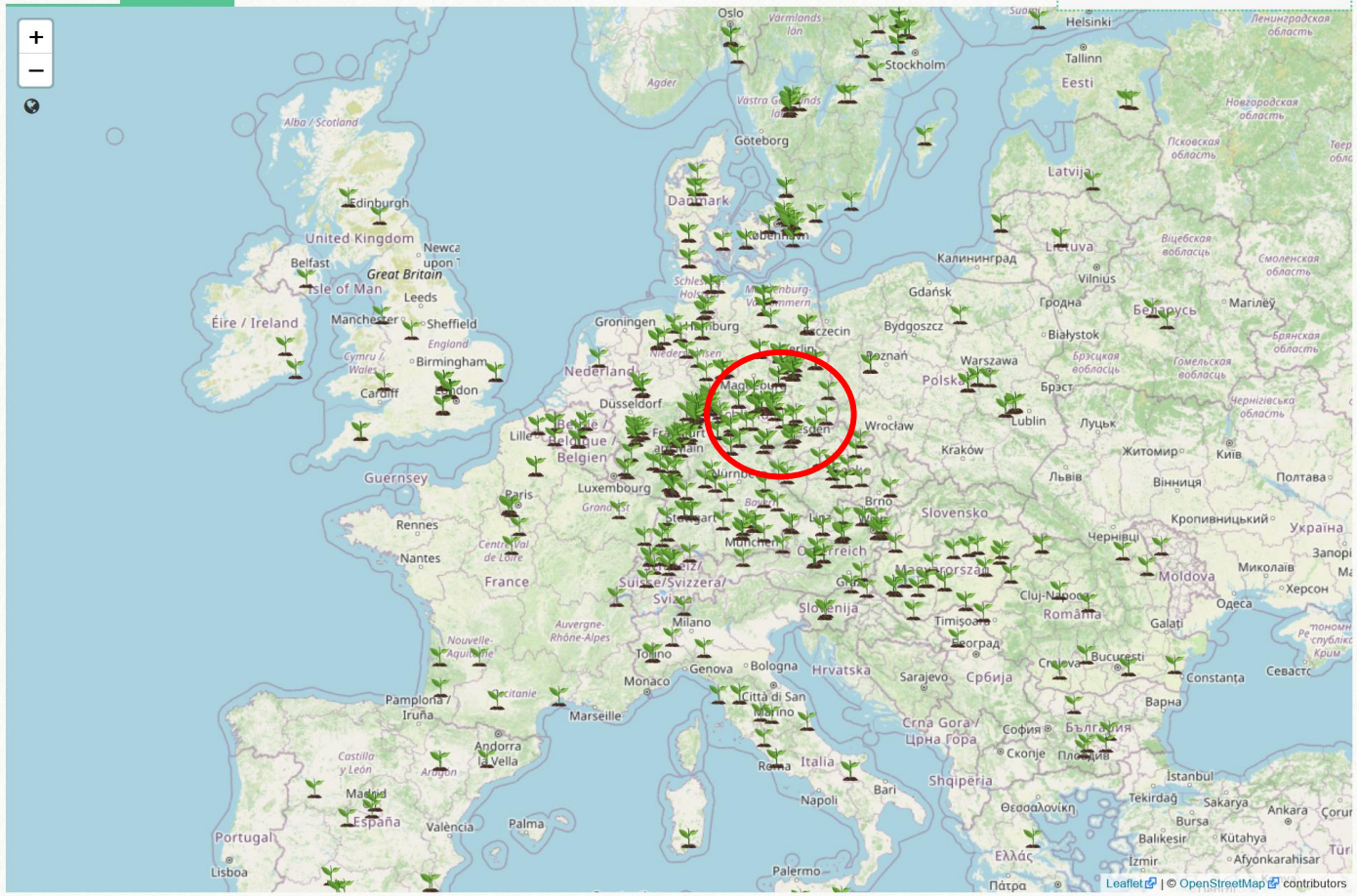
(You can get easy access to your LTE of interest by using the categories as a filter criteria.)

Search experiments, e.g. 'Sweden', 'Edinburgh', 'IOSDV', 'Ghent University', 'pH', 'maize'...

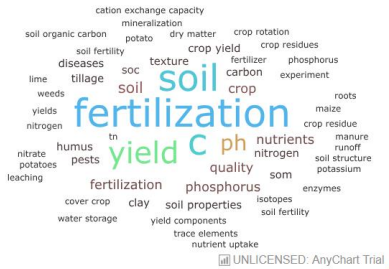
Search

Metadata Download

List | Map



LTE Wordcloud- Find on map, click on any keywords



Statistics Center

View | Reset

Categories

- Research Theme
- Land Use
- Farming Category
- LTE Project Duration
- Trial Status

In cooperation of

BONARES

For questions or to add your LTE to the map, please contact Cenk Dönmez: cenk.doenmez@zalf.de .

Link zur Übersichtskarte: https://lte.bonares.de/

Detailed Metadata of LTE "LTE Halle, Ewiger Roggen"

General | LTE Extent | Distribution | Location | Agrovoc Thesaurus

LTE Description

LTE Name	LTE Halle, Ewiger Roggen
Location	Halle
Country	Germany
LTE Start Date	1878
Status	Ongoing
Project Duration	146
LTE Institution	Martin Luther University of Halle
Institution Category	University / Technical College
DOI	

Research Information

Land Use Type	Arable land
Research Theme	organic and mineral fertilization, soil properties, yield, quality
LTE Category	Fertilization
Farming Category	Conventional

Research Parameters

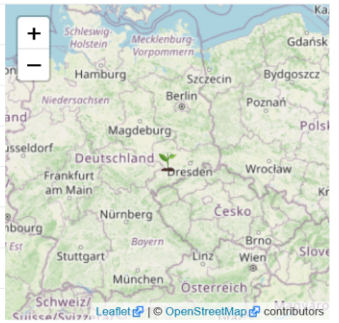
Soil Information

Detailed Metadata of LTE "LTE Methau, Dauerduengungsversuch L28"

General | LTE Extent | Distribution | Location | Agrovoc Thesaurus

LTE Description

LTE Name	LTE Methau, Dauerduengungsversuch L28
Location	Methau
Country	Germany
LTE Start Date	1966
Status	Ongoing
Project Duration	56
LTE Institution	Saechsisches Landesamt f. Umwelt, Landwirtschaft u. Geologie (LfULG)
Institution Category	Other Institution
DOI	



Research Information

Land Use Type	Arable land
Research Theme	Effect of differentiated mineral and organic fertilization on nutrient substitution, yield, soil properties, nitrate leaching etc.
LTE Category	Fertilization
Farming Category	Conventional

Research Parameters

Soil Information

Link zur Übersichtskarte: https://lte.bonares.de/

Wir wollen das System „Klima-Boden-Pflanze“ verstehen

Wetterstationen sind hierfür wichtig – genauso wie digitale Messtechnik & Feldsensorik


Foto: BayWa

Foto: iStock


Foto: Agrarheute.com

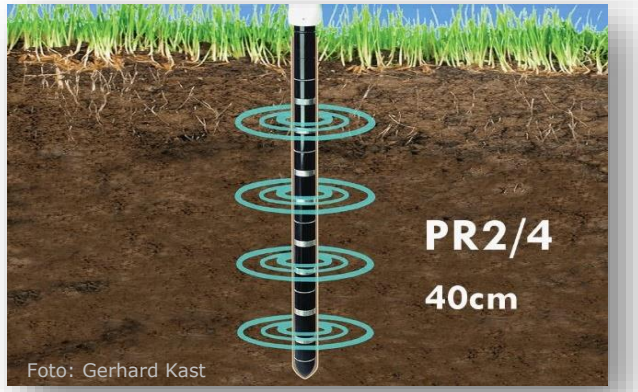


Foto: Gerhard Kast


Foto: Veronika Haas

Moderne Sensorsysteme/Feldsensorik

Agrarsystem-Modellierung

Klimatische Faktoren

Statistische Analyse

Bodenparameter

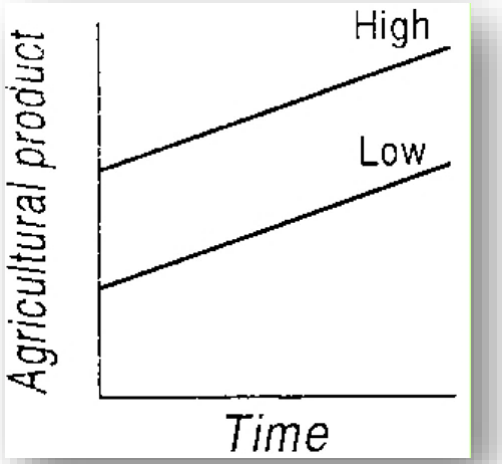
Digitale Datenbank

Pflanzenparameter

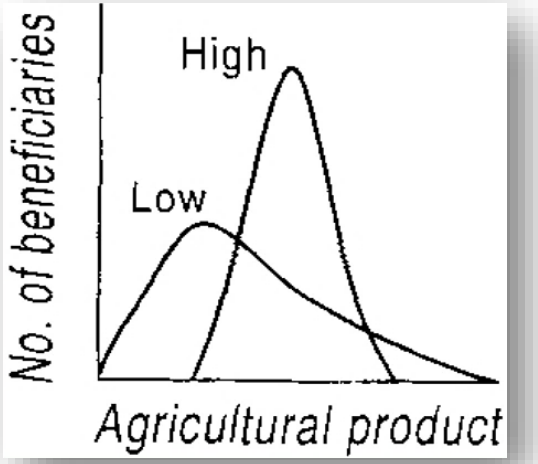
Agronomisches Management

Dauerfeldversuche zur Bewertung von Landnutzungssystemen

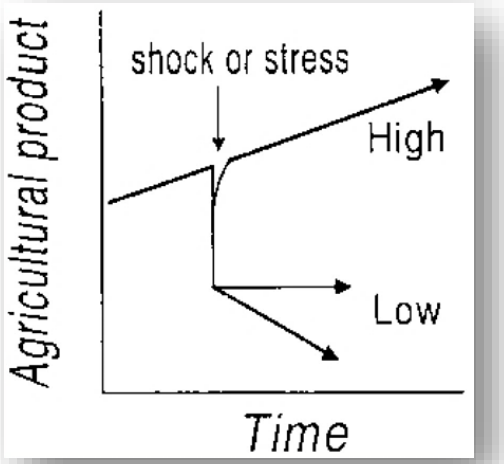
Produktivität



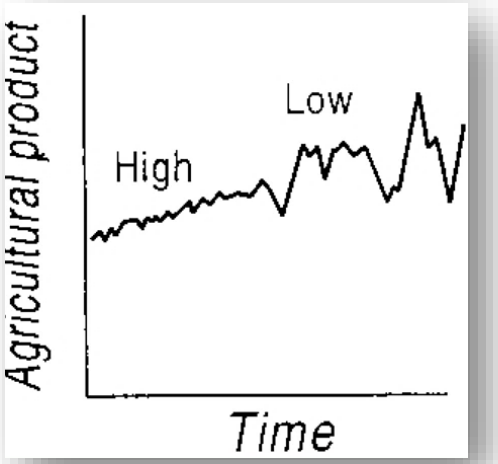
Verteilung



Robustheit



Stabilität



ROTHAMSTED RESEARCH

OUR GOALS | ENGAGE WITH US | OUR EXPERTISE | DATA & RESOURCES | NEWS | EVENTS

https://www.rothamsted.ac.uk/national-capability/the-long-term-experiments

https://www.rothamsted.ac.uk/national-capability/the-long-term-experiments

era.rothamsted.ac.uk/index.php

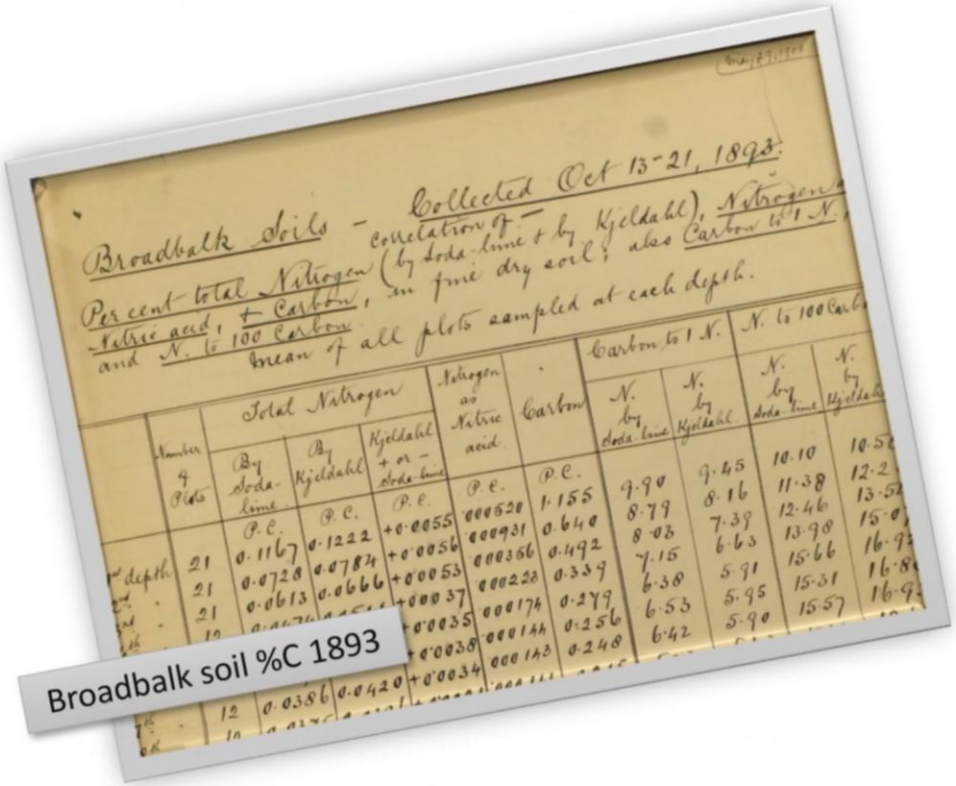
Access to data from the Rothamsted Long-term Experiments

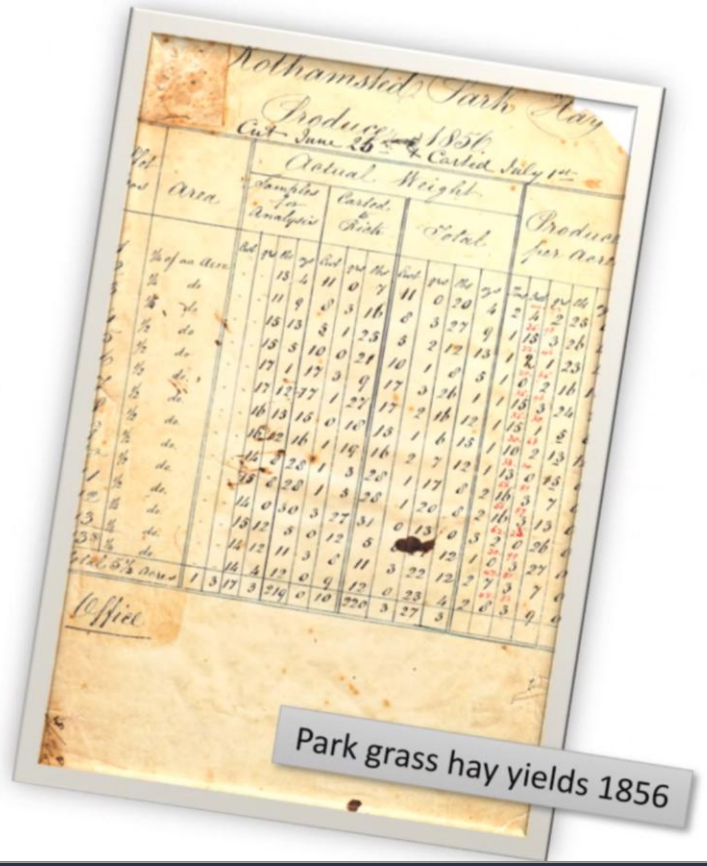
e-RAdata | e-RApubs | e-RAdoc | e-RAsearch

e-RA Rothamsted Archive

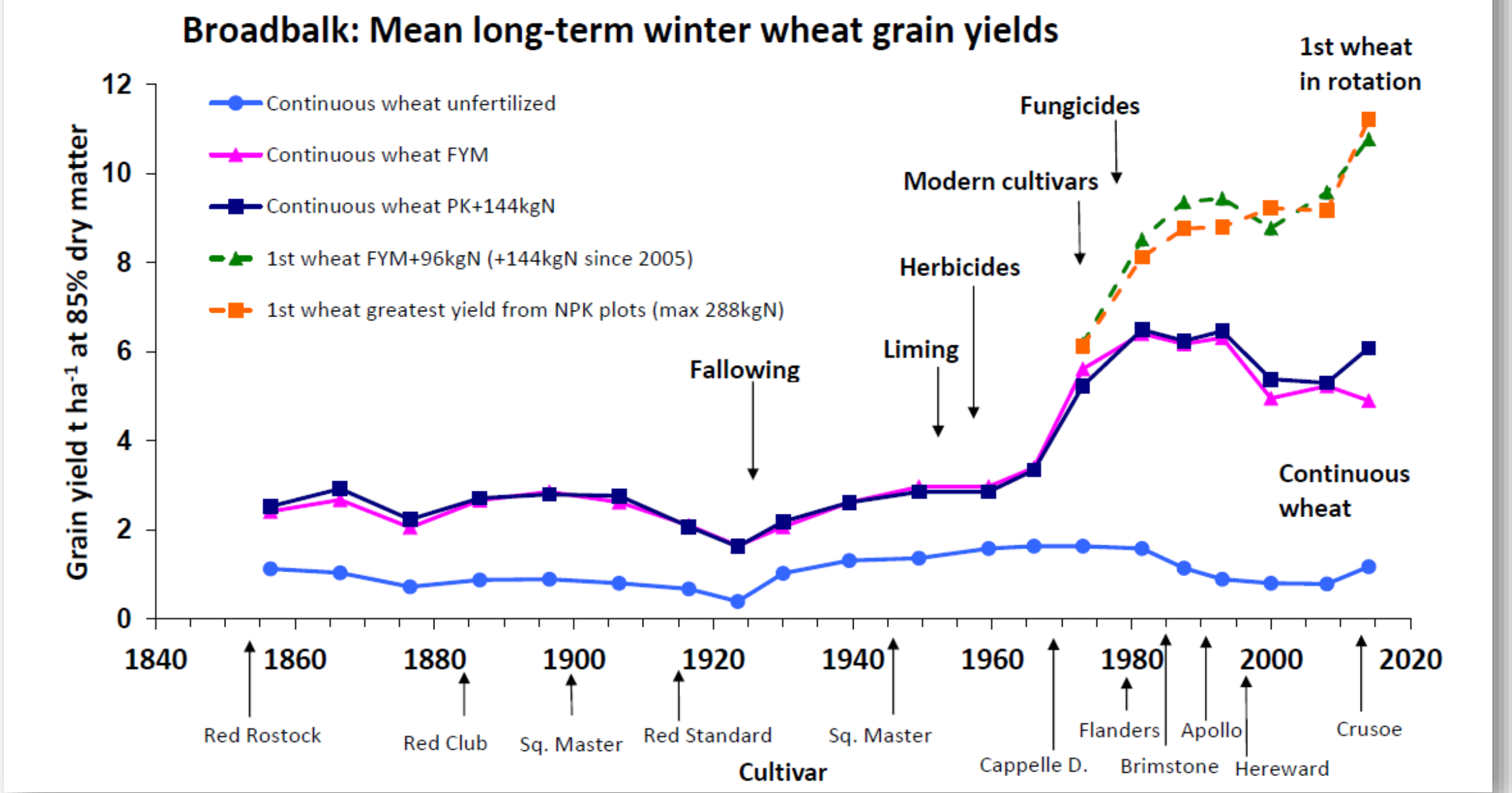
ABOUT | SITES | EXPERIMENTS | DATA | METEOROLOGICAL DATA | SAMPLE ARCHIVE

Data from the LTEs was originally recorded on paper…



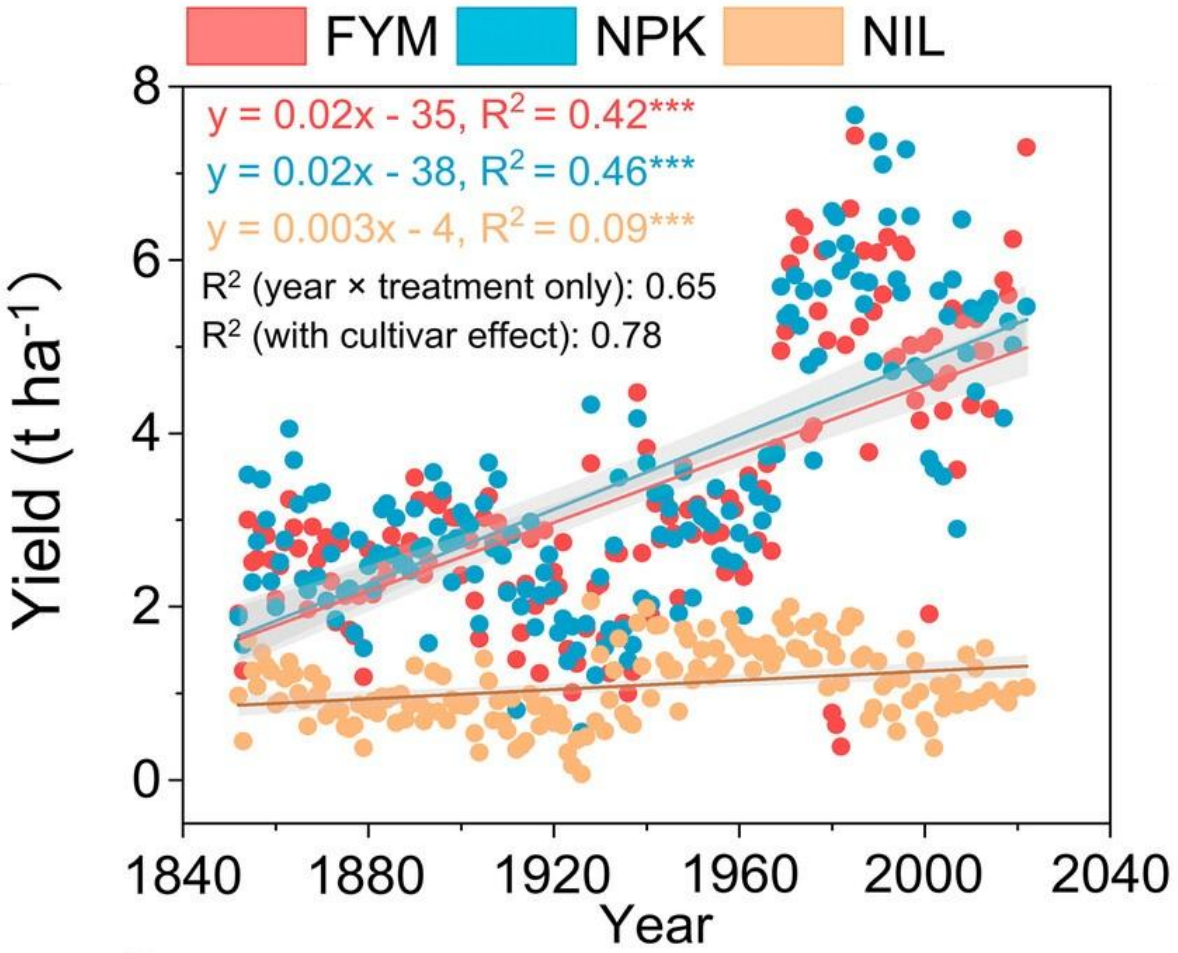


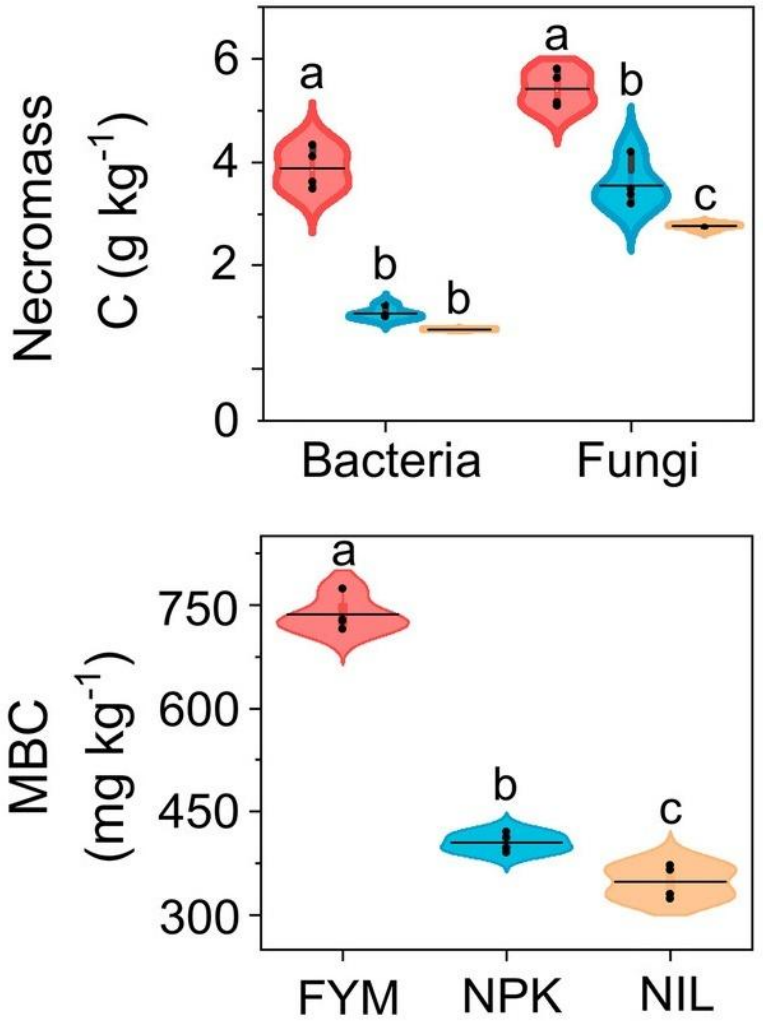
https://www.era.rothamsted.ac.uk/


Broadbalk: Mean long-term winter wheat grain yields
Grain yield t ha-1 at 85% dry matter
0
2
4
6
8
10
12
Continuous wheat unfertilized
Continuous wheat FYM
Continuous wheat PK+144kgN
1st wheat FYM+96kgN (+144kgN since 2005)
1st wheat greatest yield from NPK plots (max 288kgN)
1st wheat in rotation
Fungicides
Modern cultivars
Herbicides
Liming
Fallowing
Continuous wheat
1840
1860
1880
1900
1920
1940
1960
1980
2000
2020
Red Rostock
Red Club
Sq. Master
Red Standard
Sq. Master
Cappelle D.
Flanders
Brimstone
Apollo
Hereward
Crusoe
Cultivar

Einfluss der Düngung auf Weizenertrag & mikrobielle Biomasse

Broadbalk Experiment Rothamsted, UK (started 1843)



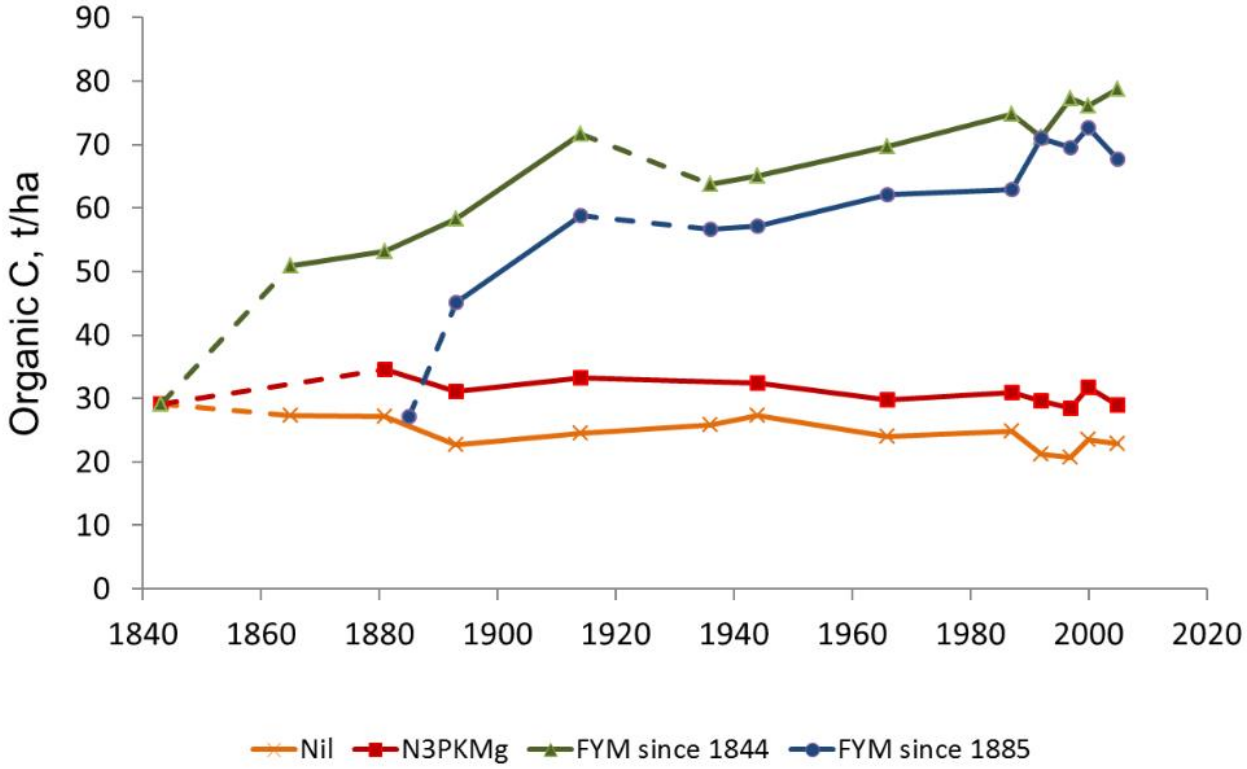


https://doi.org/10.1111/gcb.70906

Einfluss der Düngung auf Entwicklung des Bodenkohlenstoffs

Broadbalk Experiment Rothamsted, UK (seit 1843)

Broadbalk experiment
Rothamsted Research (England)

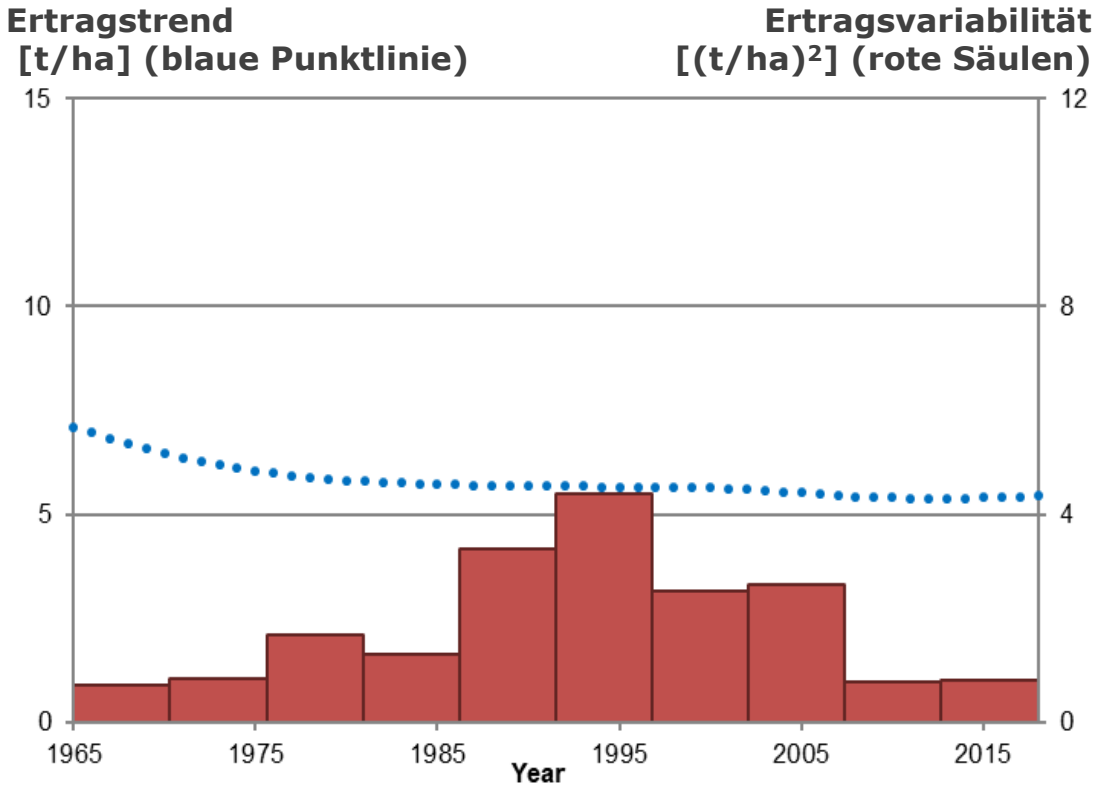


https://www.era.rothamsted.ac.uk/Broadbalk

Grünland: Langzeit-Trends in Ertrag & Ertragsvariabilität

Park Grass Experiment Rothamsted (seit 1856)

Park Grass Experiment
Rothamsted Research Centre (UK)



→ Für die Ertragsvariabilität wurden ähnliche Trends in den verschiedenen Düngungsvarianten gefunden

https://doi.org/10.1007/s13593-023-00885-w

Starker Einfluss klimatischer Faktoren auf Ertragsvariabilität

Park Grass Experiment Rothamsted (seit 1856)

Treatment	Fertilisation	Liming	General model statistic			First selected covariable				Second selected covariable			
			Durbin-Watson test	Adjusted R Square	VIF Collinearity	Name of covariable	Regression coefficient B	Standardized coefficient Beta	p value	Name of covariable	Regression coefficient B	Standardized coefficient Beta	p value
3	Nil	pH 7	2.02	0.29	1.00	Water stress days_March_October	-0.02	-0.55	0.00	none selected			
		pH 6	1.68	0.23	1.00	Water stress days_March_October	-0.02	-0.49	0.00	none selected			
		pH 5	1.62	0.29	1.00	Water stress days_March_October	-0.02	-0.54	0.00	none selected			
		no chalk	1.58	0.25	1.00	Water stress days_March_October	-0.02	-0.50	0.00	none selected			
7/2	P K Na Mg	pH 7	1.97	0.49	1.36	Water stress days_March_October	-0.03	-0.47	0.00	Temperature_July_August	-0.66	-0.35	0.00
		pH 6	2.05	0.37	1.36	Water stress days_March_October	-0.02	-0.37	0.01	Temperature_July_August	-0.63	-0.35	0.01
		pH 5	1.76	0.34	1.01	Water stress days_March_October	-0.04	-0.52	0.00	Temperature_March_April	0.96	0.35	0.00
		no chalk	1.77	0.25	1.00	Water stress days_March_October	-0.03	-0.52	0.00	none selected			
6	N1 P K Na Mg	pH 7	2.08	0.40	1.29	Water stress days_March_October	-0.02	-0.40	0.00	Temperature_July_August	-0.70	-0.40	0.00
		pH 6										-0.37	0.01
		pH 5			n/a								
		no chalk											
9/2	N2 P K Na Mg	pH 7	1.71								-0.79	-0.31	0.02
		pH 6	1.51	0.36	1.36	Water stress days_March_October	-0.02	-0.39	0.01	Temperature_July_August	-0.64	-0.38	0.01
		pH 5	1.70	0.35	1.36	Water stress days_March_October	-0.02	-0.36	0.01	Temperature_July_August	-0.74	-0.35	0.01
		no chalk									-0.85	-0.32	0.02
11/1	N3 P K Na Mg	pH 7									-0.73	-0.33	0.02
		pH 6					0.02	0.29	0.04	Temperature_July_August	0.67	-0.34	0.02
		pH 5	1.71	0.26	1.36	Temperature_July_August	-1.30	-0.52	0.00	Waterstress_March_October	-0.02	-0.25	0.05
		no chalk	1.82	0.35	1.36	Temperature_July_August	-1.47	-0.60	0.00	Waterstress_March_October	-0.01	-0.16	0.05
13/2	FYM/PM	pH 7	1.72	0.34	1.36	Temperature_July_August	-0.91	-0.40	0.00	Waterstress_March_October	-0.02	-0.29	0.03
		pH 6	2.16	0.38	1.36	Temperature_July_August	-0.91	-0.44	0.00	Waterstress_March_October	-0.02	-0.29	0.03
		pH 5	1.72	0.33	1.36	Water stress days_March_October	-0.03	-0.39	0.01	Temperature_July_August	-0.67	-0.30	0.03
		no chalk	1.64	0.21	1.00	Water stress days_March_October	-0.03	-0.47	0.00	none selected			
17	N*1	pH 7	1.95	0.31	1.19	Water stress days_March_October	-0.02	-0.42	0.00	Temperature_May_June	-0.25	-0.27	0.04
		pH 6	1.91	0.23	1.36	Water stress days_March_October	-0.01	-0.29	0.04	Temperature_May_June	-0.24	-0.29	0.05
		pH 5	1.80	0.32	1.36	Temperature_May_June	-0.25	-0.58	0.00	Waterstress_March_October	-0.02	-0.34	0.01
		no chalk	1.73	0.28	1.00	Temperature_July_August	-0.58	-0.46	0.00	Waterstress_March_October	-0.01	-0.22	0.05

Trockenstress-Tage (März-Oktober) & Temperatur (Juli-August)

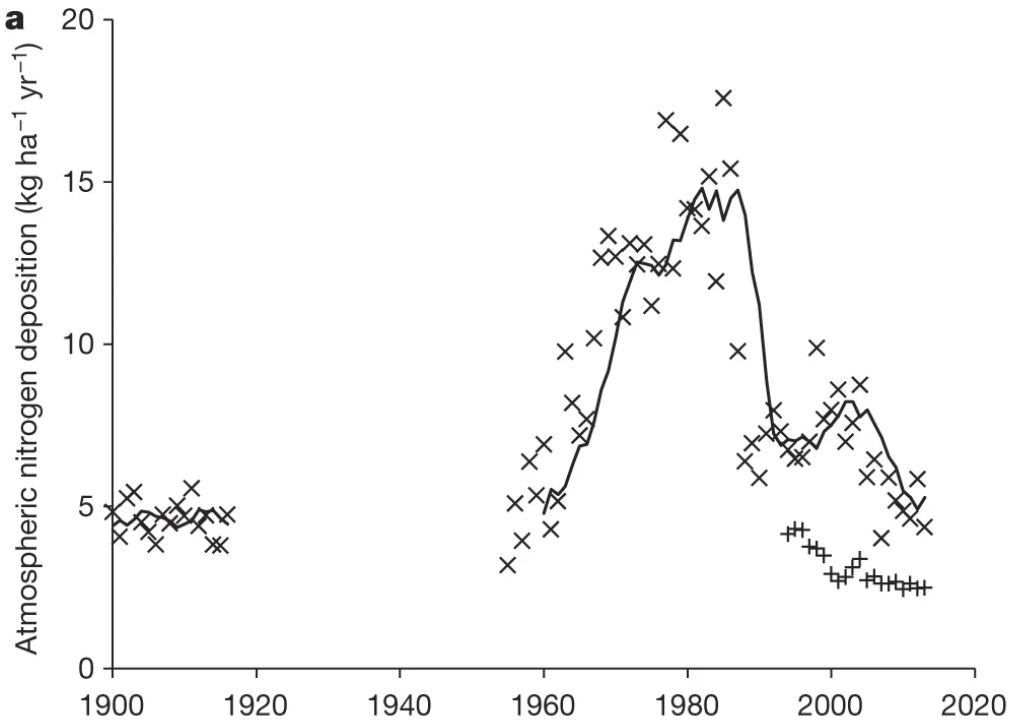
wurden als die zwei Hauptfaktoren identifiziert,

welche circa ein Drittel der Ertragsvariabilität erklären.

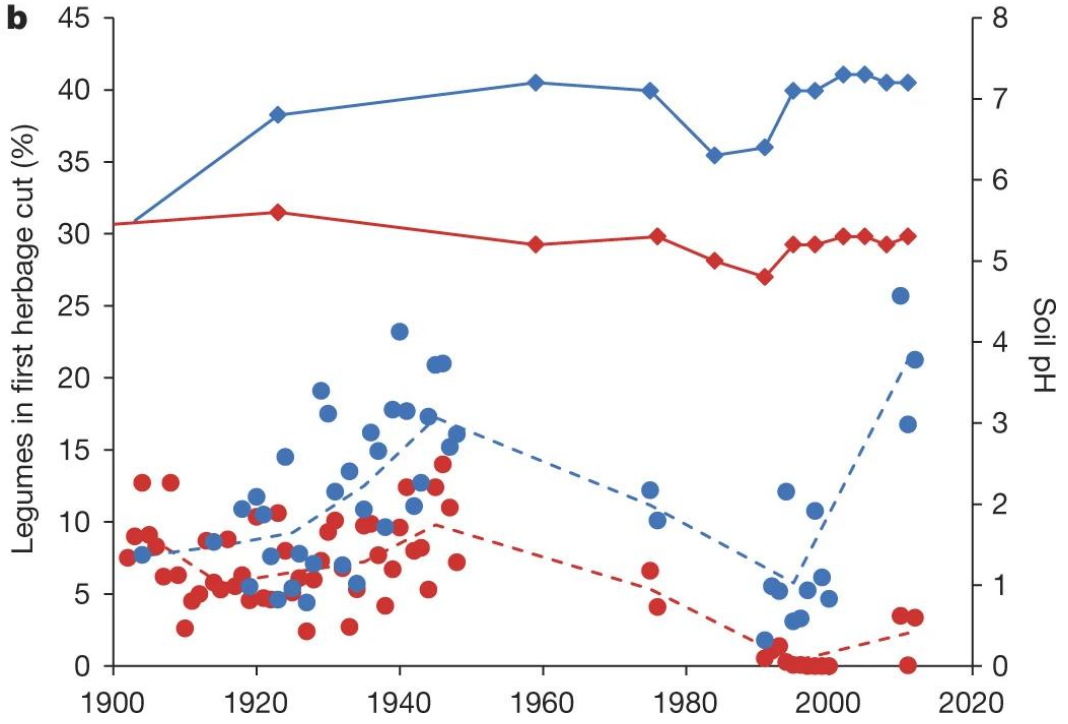
https://doi.org/10.1007/s13593-023-00885-w

Grünland-Biodiversität erholt sich von langjähriger N-Deposition

Park Grass Experiment Rothamsted (seit 1856)



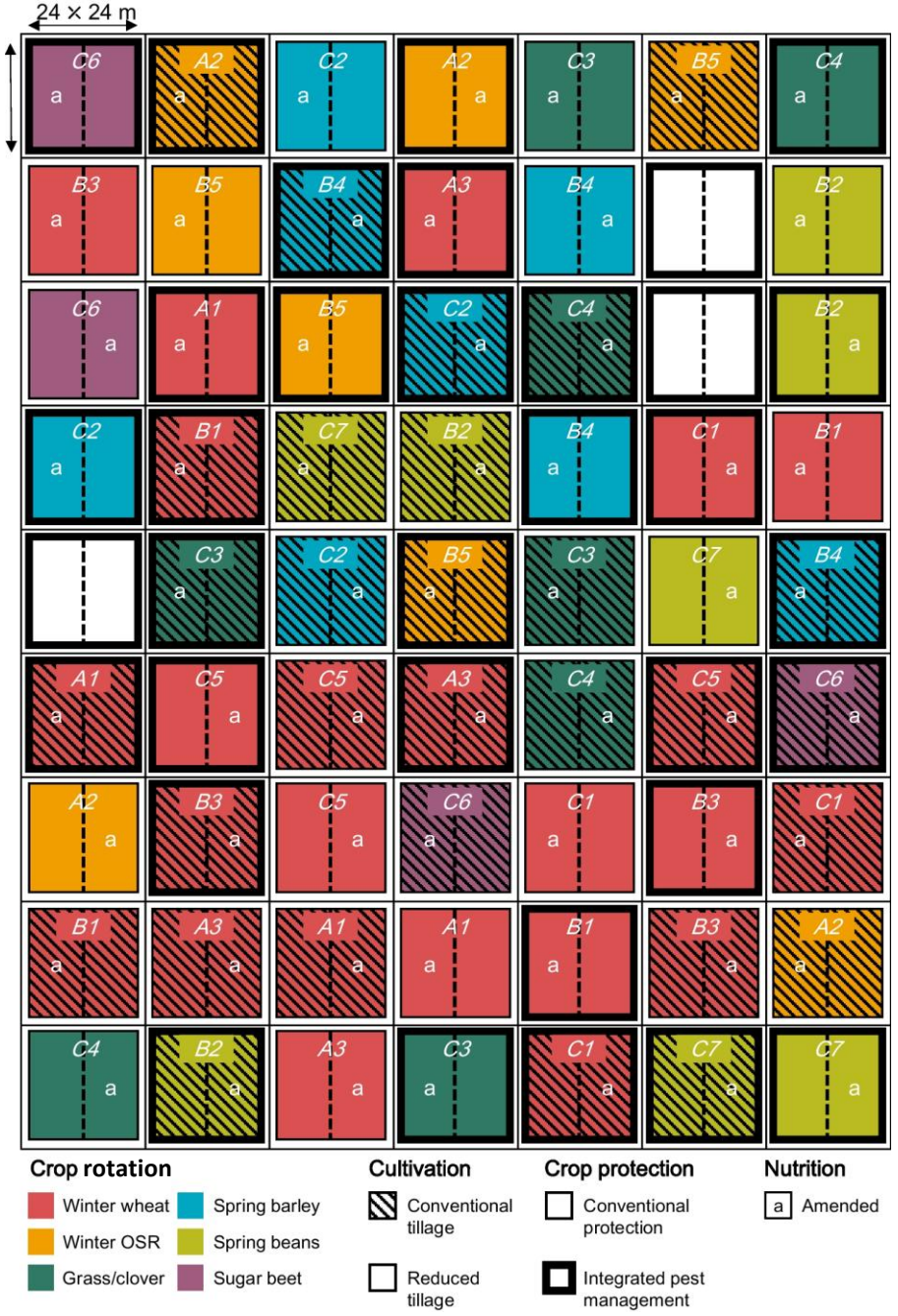
a. Veränderungen in wet (×) und dry (+) N deposition
Linie zeigt gleitenden 5-Jahresdurchschnitt



b, Veränderungen des Anteils an Leguminosen
Variante mit Kalkung: blaue Punkte, blaue Strichellinie
Variante ohne Kalkung: rote Punkte, rote Strichellinie

https://doi.org/10.1038/nature16444

A new Rothamsted long-term field experiment for the twenty-first century: principles and practice



https://doi.org/10.1007/s13593-023-00914-8

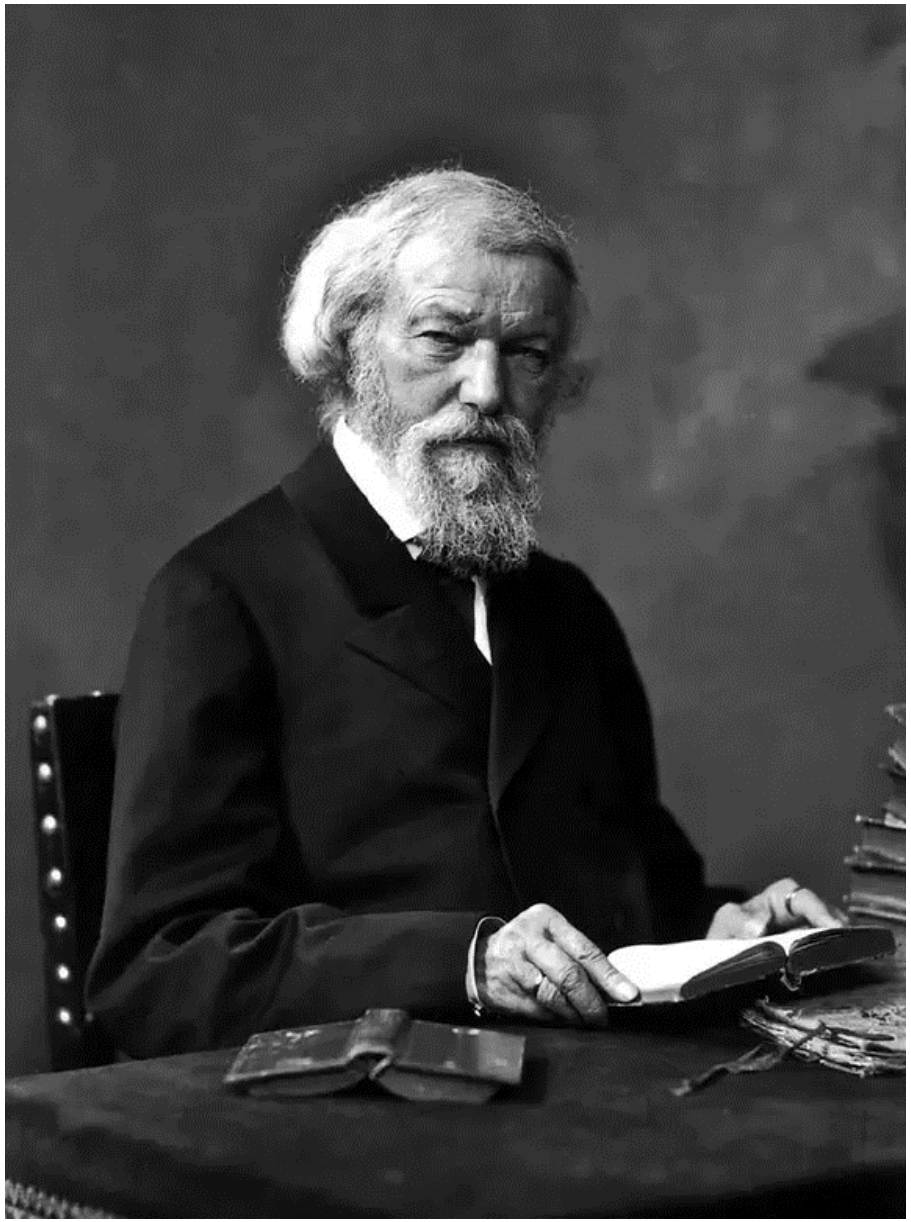
LTEhub

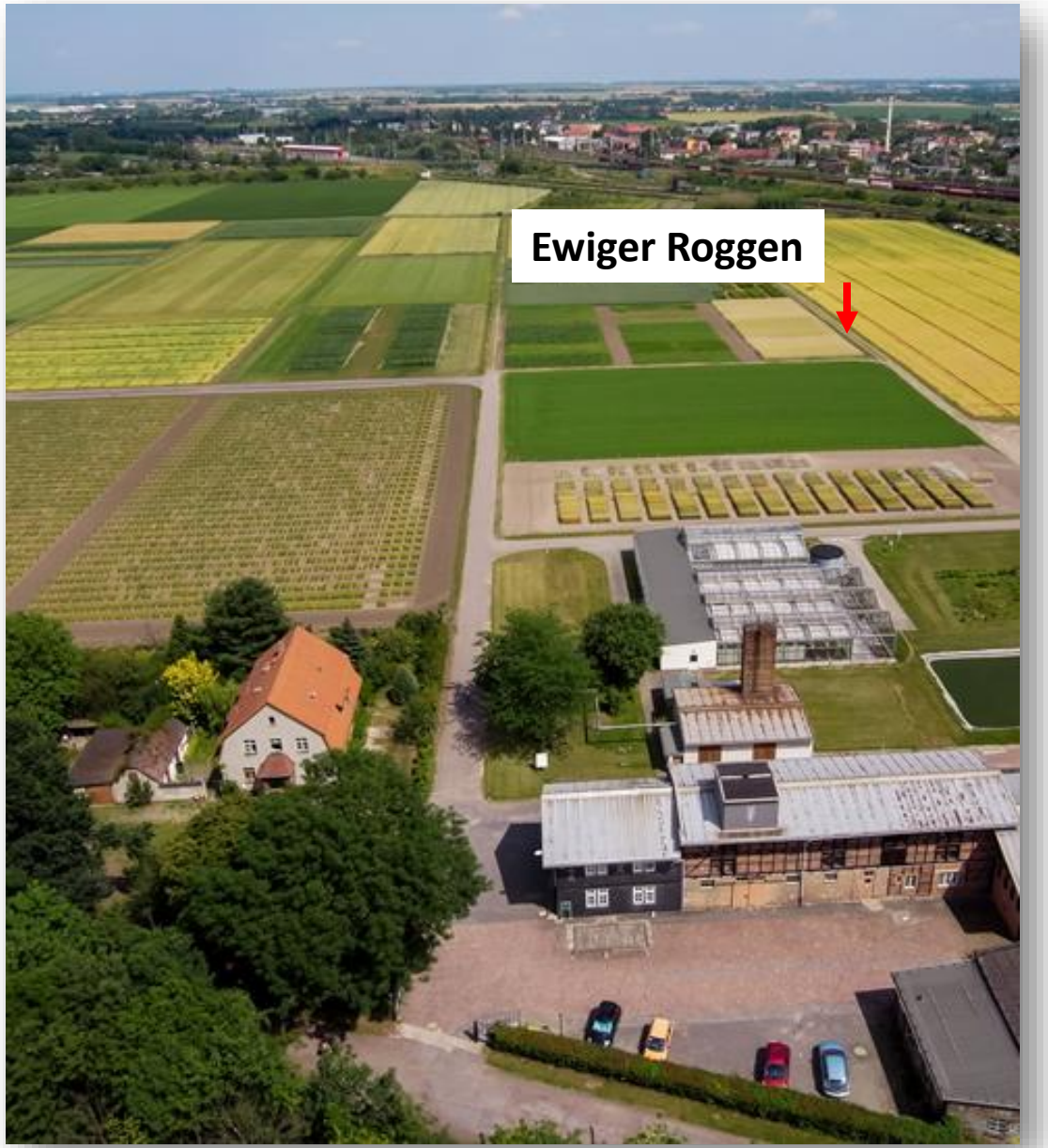
Welcome to the research hub on long-term field experiments
of the Department of Agronomy and Organic Farming
at the Martin Luther University Halle-Wittenberg

MARTIN-LUTHER-UNIVERSITÄT
HALLE-WITTENBERG

Dr. Karolin Kunz
Kuratorin

Dr. Thomas Reitz
Feldversuchswesen




Ewiger Roggen

Dauerfeldversuch „Ewiger Roggen“

1878-1893

1894-1952

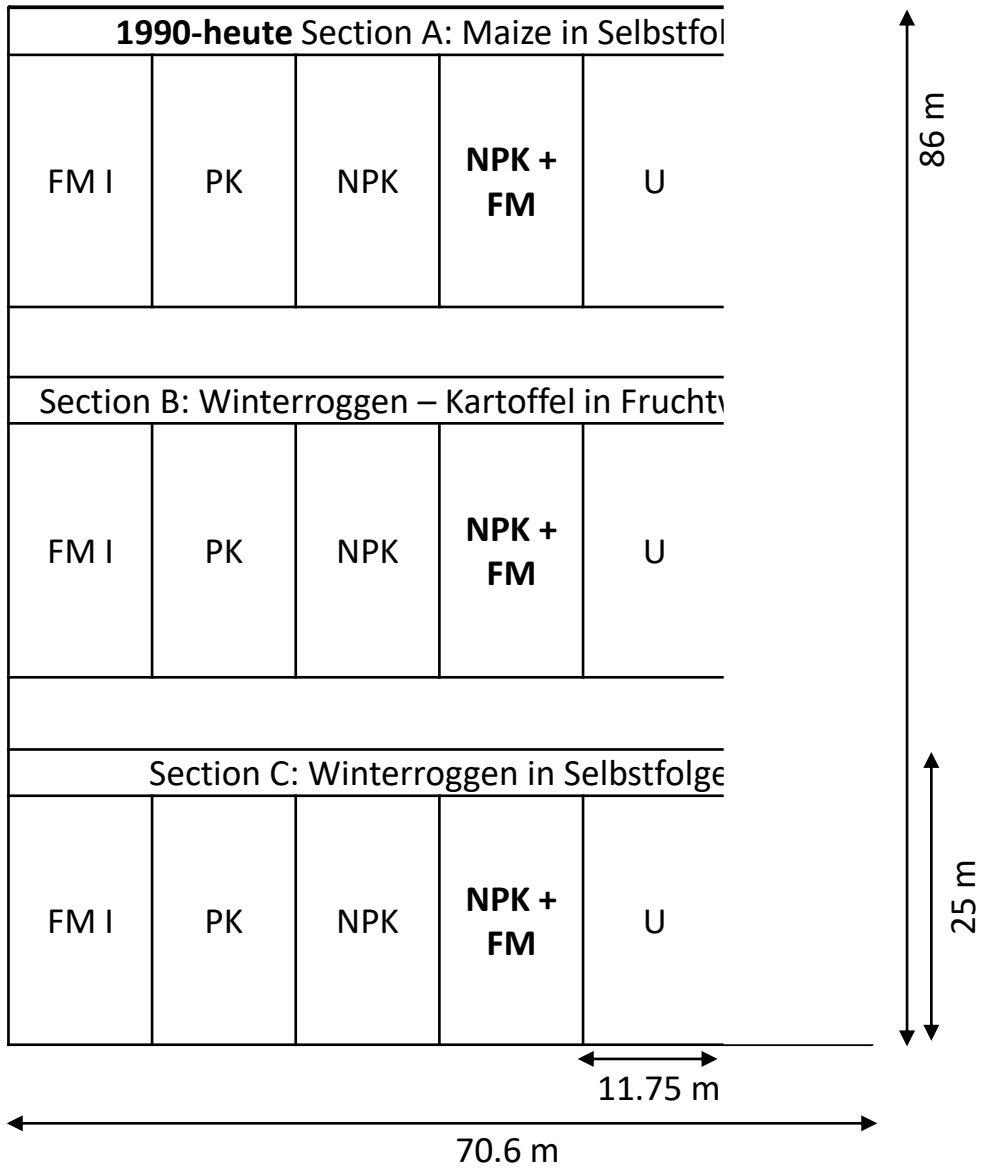
1953-1989

1990-heute

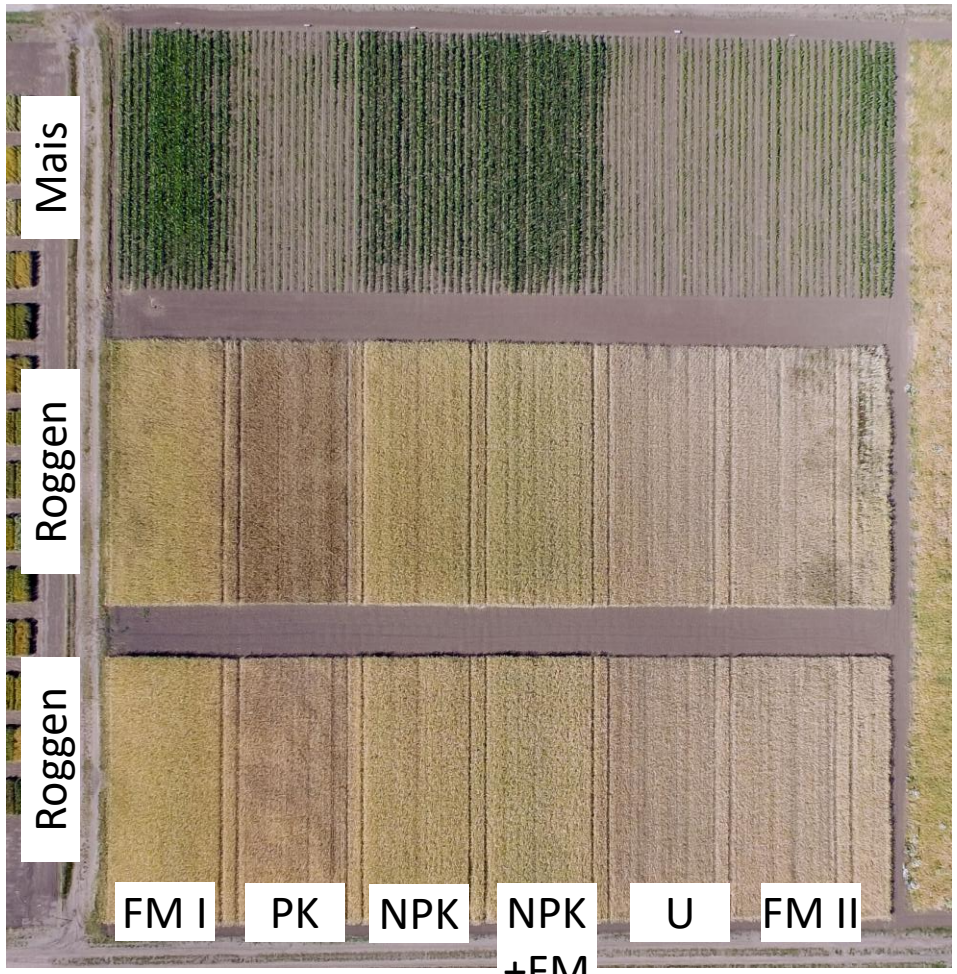
	FM I	PK	NPK	**NPK +FM**	U	FM II
N	**60**	-	**60**	**120**	-	-
P	**18**	24	24	**42**	-	-
K	**55**	75	75	**130**	-	-

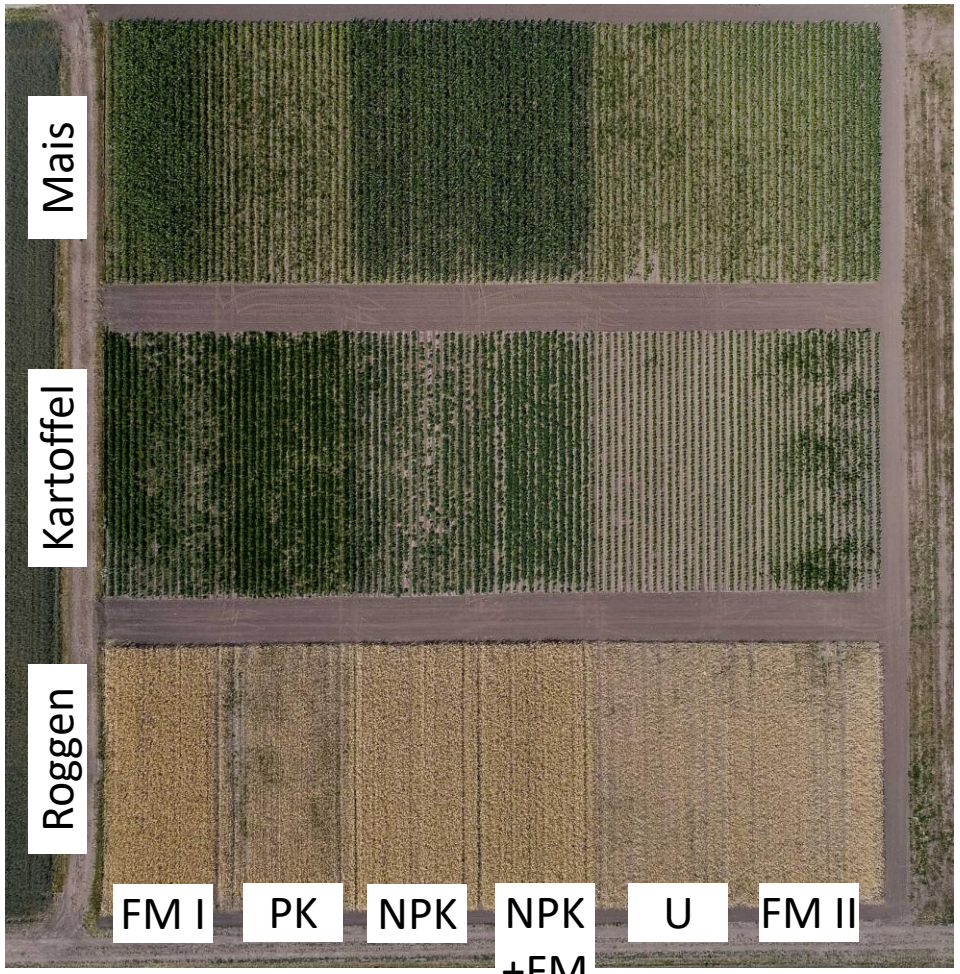
ca.12 t/ha

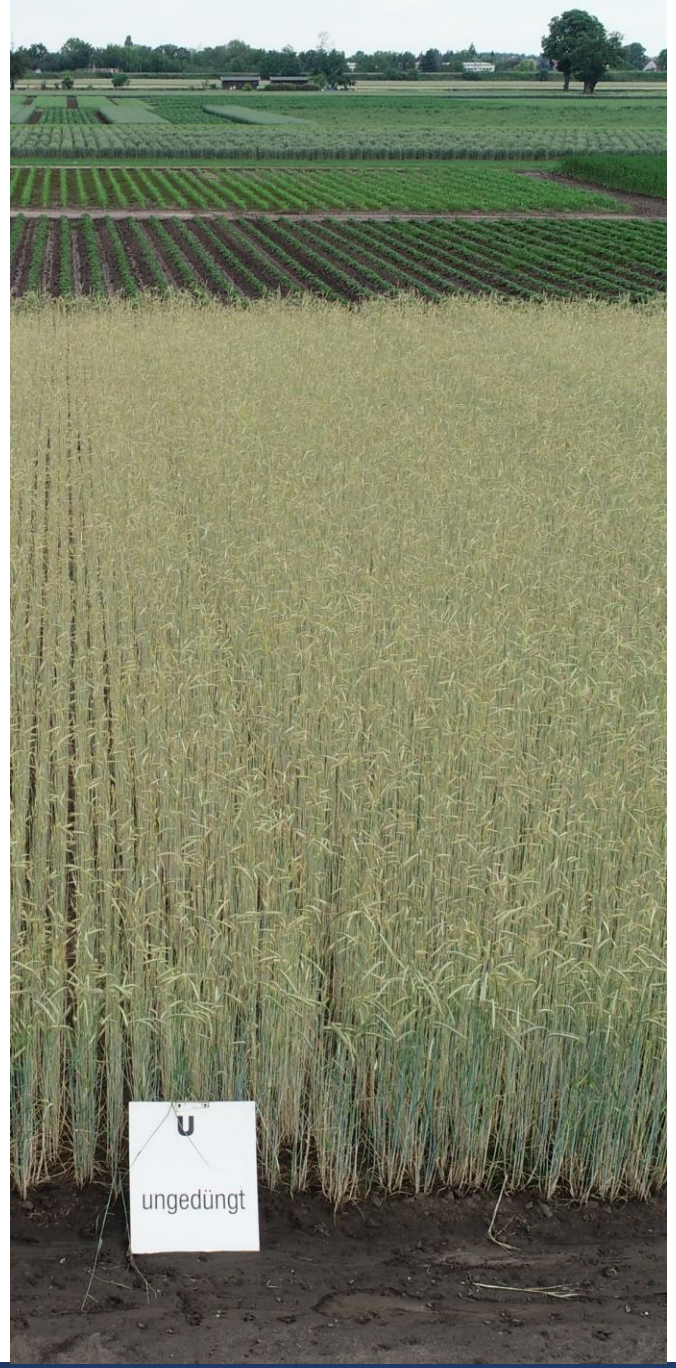
8 t/ha

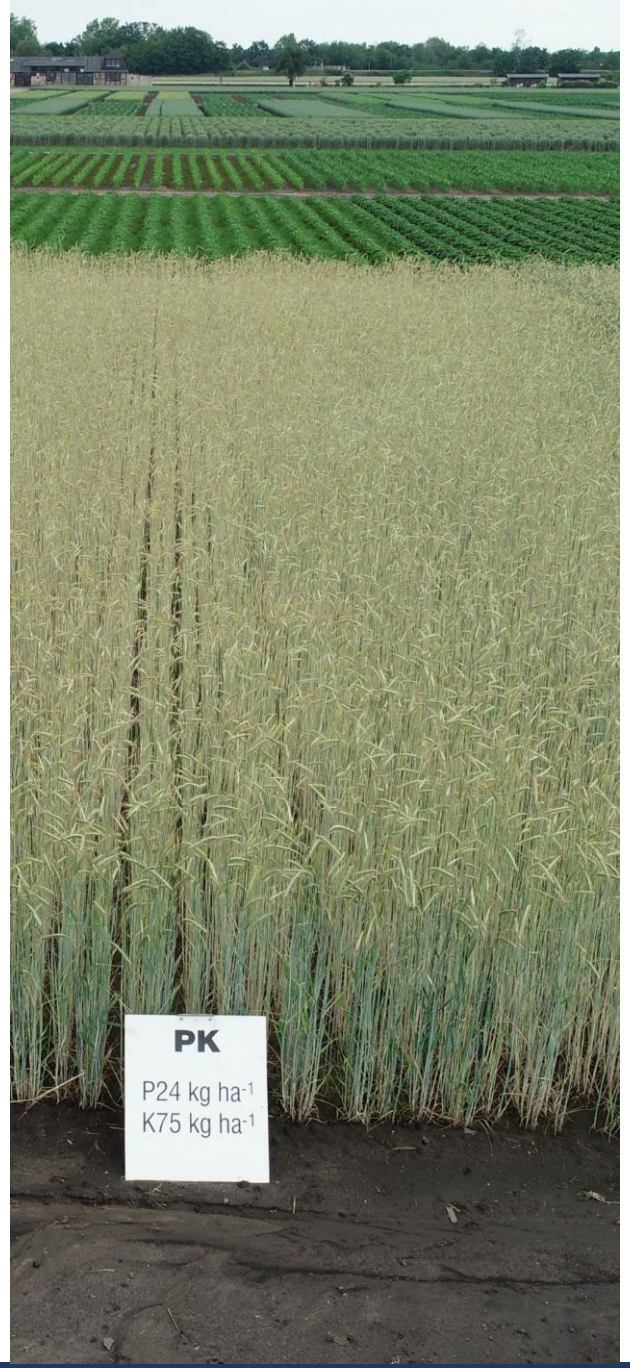


Dauerfeldversuch „Ewiger Roggen“ am Kühnfeld, MLU Halle

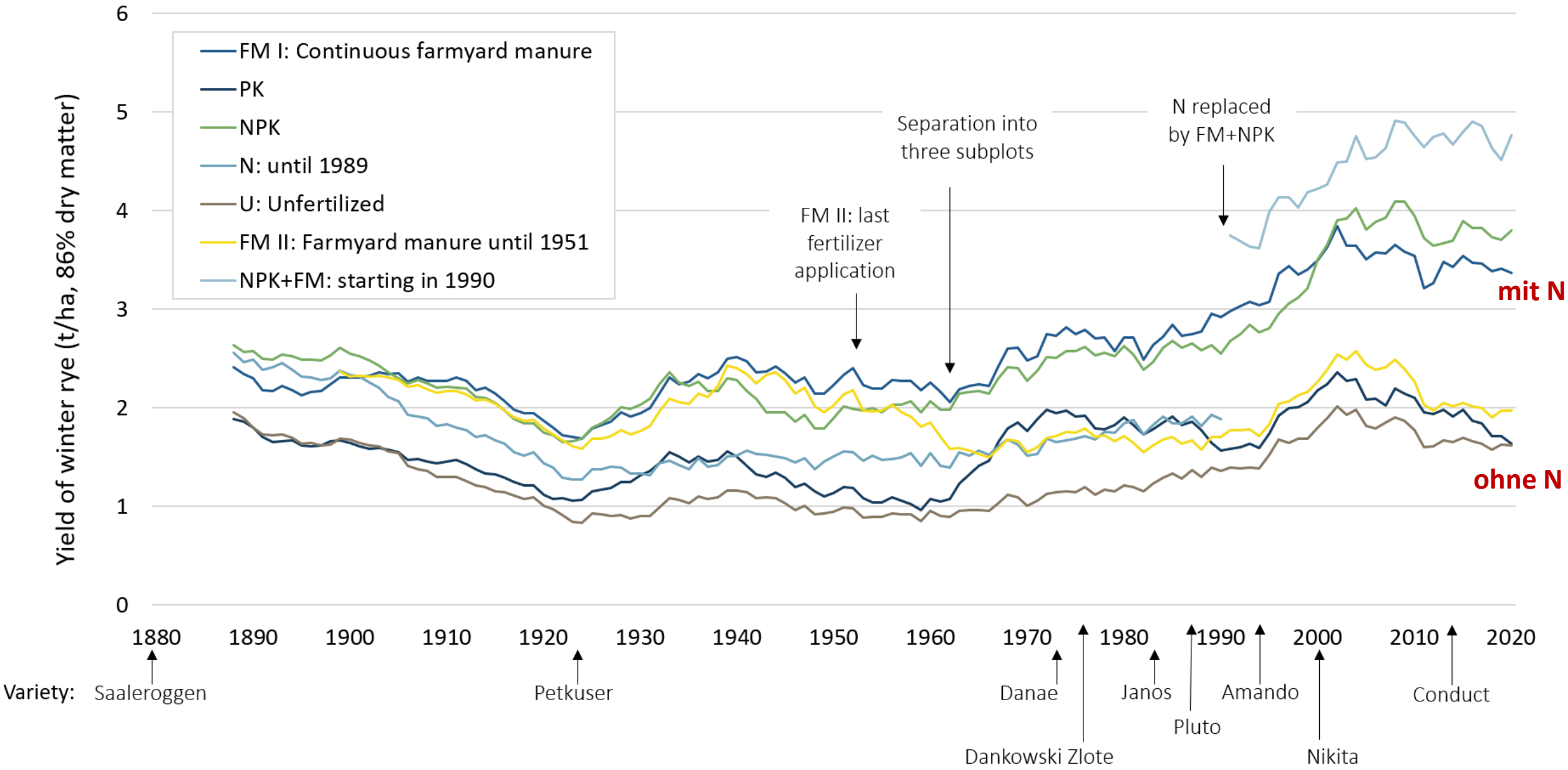




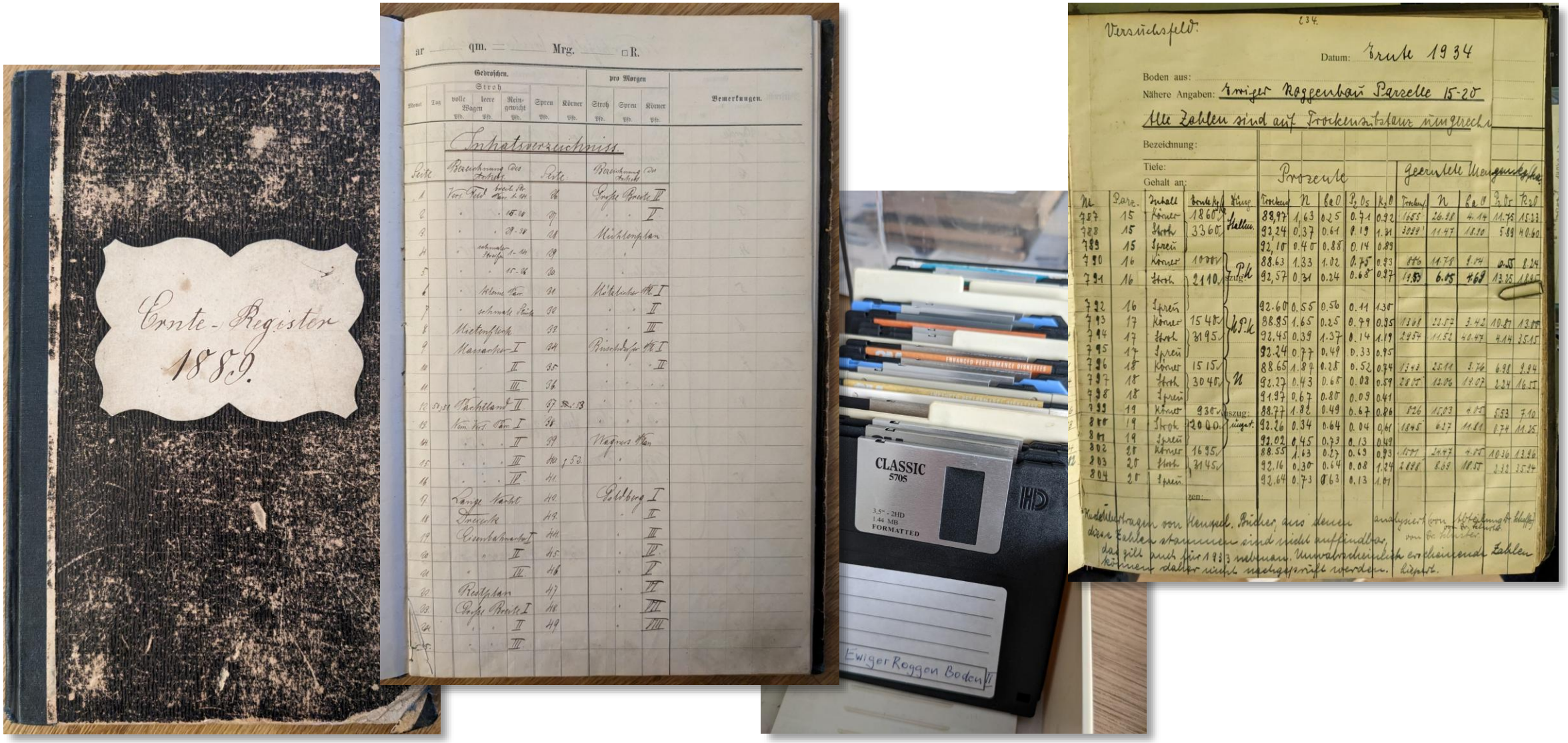

U
ungedüngt


PK
P24 kg ha-1
K75 kg ha-1


NPK
N60 kg ha-1
P24 kg ha-1
K75 kg ha-1
bis 1990 40 kg ha-1 N

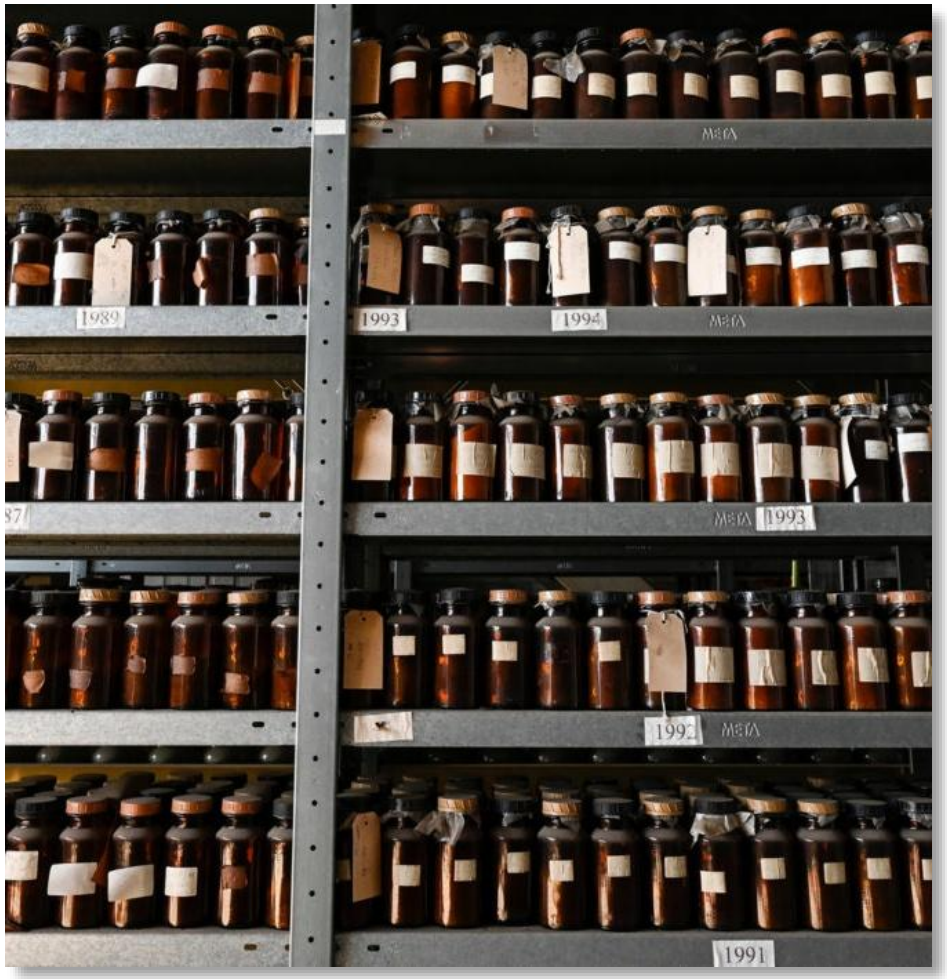

Yield of winter rye (t/ha, 86% dry matter)
0
1
2
3
4
5
6
FM I: Continuous farmyard manure
PK
NPK
N: until 1989
U: Unfertilized
FM II: Farmyard manure until 1951
NPK+FM: starting in 1990
FM II: last fertilizer application
Separation into three subplots
N replaced by FM+NPK
mit N
ohne N
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
Variety:
Saaleroggen
Petkuser
Danae
Dankowski Zlote
Janos
Pluto
Amando
Nikita
Conduct

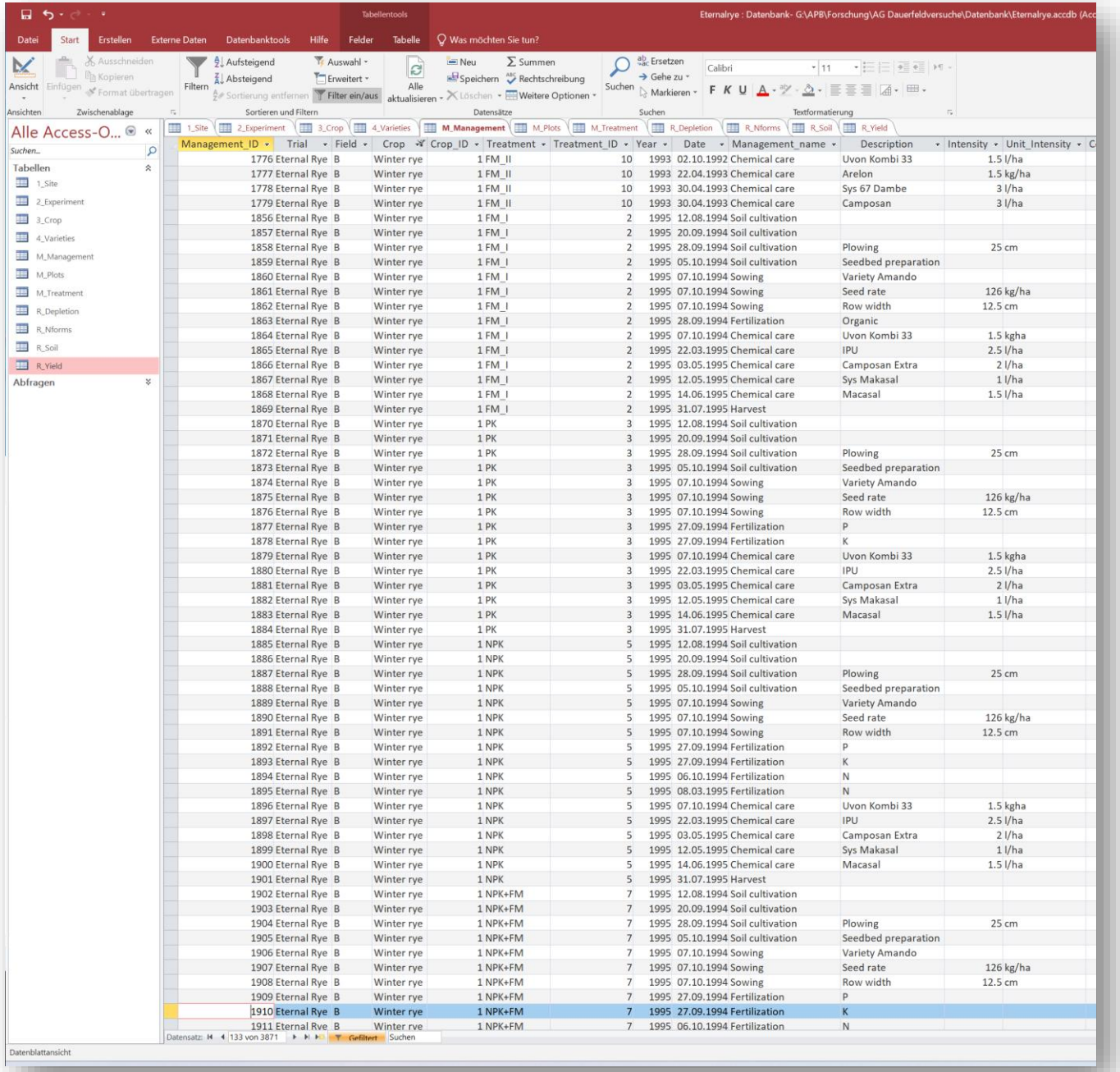
Originaldaten



Probenarchiv &

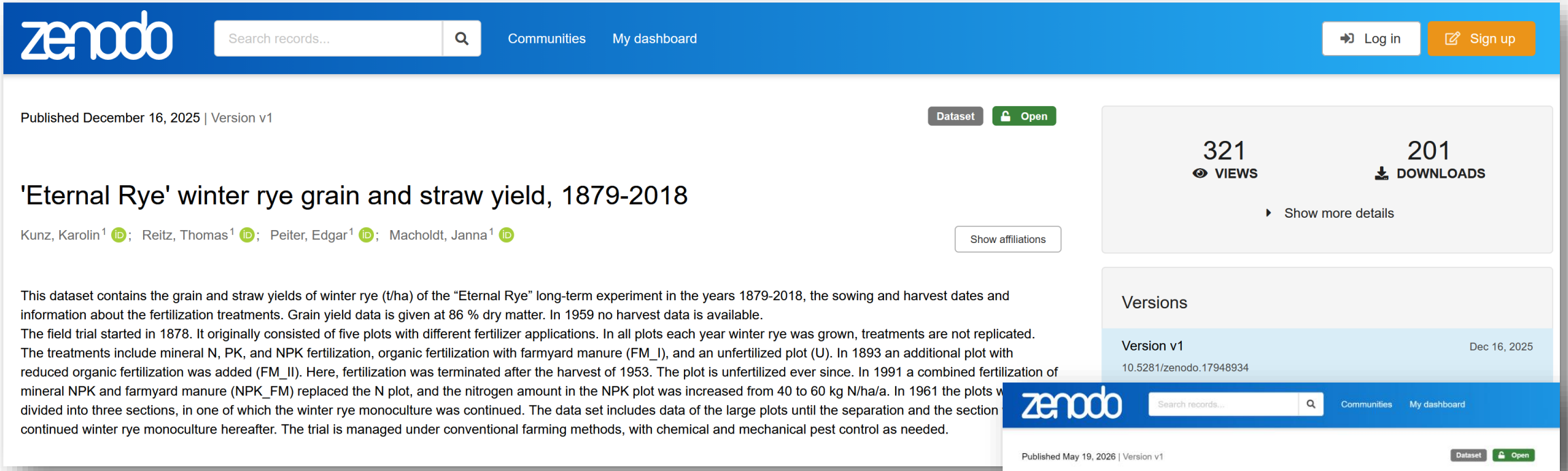
Digitale Datenbank





Management_ID	Trial	Field	Crop	Crop_ID	Treatment	Treatment_ID	Year	Date	Management_name	Description	Intensity	Unit_Intensity
1776	Eternal Rye	B	Winter rye	1	FM_II	10	1993	02.10.1992	Chemical care	Uvon Kombi 33	1.5	l/ha
1777	Eternal Rye	B	Winter rye	1	FM_II	10	1993	22.04.1993	Chemical care	Arelon	1.5	kg/ha
1778	Eternal Rye	B	Winter rye	1	FM_II	10	1993	30.04.1993	Chemical care	Sys 67 Dambe	3	l/ha
1779	Eternal Rye	B	Winter rye	1	FM_II	10	1993	30.04.1993	Chemical care	Camposan	3	l/ha
1856	Eternal Rye	B	Winter rye	1	FM_I	2	1995	12.08.1994	Soil cultivation			
1857	Eternal Rye	B	Winter rye	1	FM_I	2	1995	20.09.1994	Soil cultivation			
1858	Eternal Rye	B	Winter rye	1	FM_I	2	1995	28.09.1994	Soil cultivation	Plowing	25	cm
1859	Eternal Rye	B	Winter rye	1	FM_I	2	1995	05.10.1994	Soil cultivation	Seedbed preparation		
1860	Eternal Rye	B	Winter rye	1	FM_I	2	1995	07.10.1994	Sowing	Variety Amando		
1861	Eternal Rye	B	Winter rye	1	FM_I	2	1995	07.10.1994	Sowing	Seed rate	126	kg/ha
1862	Eternal Rye	B	Winter rye	1	FM_I	2	1995	07.10.1994	Sowing	Row width	12.5	cm
1863	Eternal Rye	B	Winter rye	1	FM_I	2	1995	28.09.1994	Fertilization	Organic		
1864	Eternal Rye	B	Winter rye	1	FM_I	2	1995	07.10.1994	Chemical care	Uvon Kombi 33	1.5	kgha
1865	Eternal Rye	B	Winter rye	1	FM_I	2	1995	22.03.1995	Chemical care	IPU	2.5	l/ha
1866	Eternal Rye	B	Winter rye	1	FM_I	2	1995	03.05.1995	Chemical care	Camposan Extra	2	l/ha
1867	Eternal Rye	B	Winter rye	1	FM_I	2	1995	12.05.1995	Chemical care	Sys Makasal	1	l/ha
1868	Eternal Rye	B	Winter rye	1	FM_I	2	1995	14.06.1995	Chemical care	Macasal	1.5	l/ha
1869	Eternal Rye	B	Winter rye	1	FM_I	2	1995	31.07.1995	Harvest			
1870	Eternal Rye	B	Winter rye	1	PK	3	1995	12.08.1994	Soil cultivation			
1871	Eternal Rye	B	Winter rye	1	PK	3	1995	20.09.1994	Soil cultivation			
1872	Eternal Rye	B	Winter rye	1	PK	3	1995	28.09.1994	Soil cultivation	Plowing	25	cm
1873	Eternal Rye	B	Winter rye	1	PK	3	1995	05.10.1994	Soil cultivation	Seedbed preparation		
1874	Eternal Rye	B	Winter rye	1	PK	3	1995	07.10.1994	Sowing	Variety Amando		
1875	Eternal Rye	B	Winter rye	1	PK	3	1995	07.10.1994	Sowing	Seed rate	126	kg/ha
1876	Eternal Rye	B	Winter rye	1	PK	3	1995	07.10.1994	Sowing	Row width	12.5	cm
1877	Eternal Rye	B	Winter rye	1	PK	3	1995	27.09.1994	Fertilization	P		
1878	Eternal Rye	B	Winter rye	1	PK	3	1995	27.09.1994	Fertilization	K		
1879	Eternal Rye	B	Winter rye	1	PK	3	1995	07.10.1994	Chemical care	Uvon Kombi 33	1.5	kgha
1880	Eternal Rye	B	Winter rye	1	PK	3	1995	22.03.1995	Chemical care	IPU	2.5	l/ha
1881	Eternal Rye	B	Winter rye	1	PK	3	1995	03.05.1995	Chemical care	Camposan Extra	2	l/ha
1882	Eternal Rye	B	Winter rye	1	PK	3	1995	12.05.1995	Chemical care	Sys Makasal	1	l/ha
1883	Eternal Rye	B	Winter rye	1	PK	3	1995	14.06.1995	Chemical care	Macasal	1.5	l/ha
1884	Eternal Rye	B	Winter rye	1	PK	3	1995	31.07.1995	Harvest			
1885	Eternal Rye	B	Winter rye	1	NPK	5	1995	12.08.1994	Soil cultivation			
1886	Eternal Rye	B	Winter rye	1	NPK	5	1995	20.09.1994	Soil cultivation			
1887	Eternal Rye	B	Winter rye	1	NPK	5	1995	28.09.1994	Soil cultivation	Plowing	25	cm
1888	Eternal Rye	B	Winter rye	1	NPK	5	1995	05.10.1994	Soil cultivation	Seedbed preparation		
1889	Eternal Rye	B	Winter rye	1	NPK	5	1995	07.10.1994	Sowing	Variety Amando		
1890	Eternal Rye	B	Winter rye	1	NPK	5	1995	07.10.1994	Sowing	Seed rate	126	kg/ha
1891	Eternal Rye	B	Winter rye	1	NPK	5	1995	07.10.1994	Sowing	Row width	12.5	cm
1892	Eternal Rye	B	Winter rye	1	NPK	5	1995	27.09.1994	Fertilization	P		
1893	Eternal Rye	B	Winter rye	1	NPK	5	1995	27.09.1994	Fertilization	K		
1894	Eternal Rye	B	Winter rye	1	NPK	5	1995	06.10.1994	Fertilization	N		
1895	Eternal Rye	B	Winter rye	1	NPK	5	1995	08.03.1995	Fertilization	N		
1896	Eternal Rye	B	Winter rye	1	NPK	5	1995	07.10.1994	Chemical care	Uvon Kombi 33	1.5	kgha
1897	Eternal Rye	B	Winter rye	1	NPK	5	1995	22.03.1995	Chemical care	IPU	2.5	l/ha
1898	Eternal Rye	B	Winter rye	1	NPK	5	1995	03.05.1995	Chemical care	Camposan Extra	2	l/ha
1899	Eternal Rye	B	Winter rye	1	NPK	5	1995	12.05.1995	Chemical care	Sys Makasal	1	l/ha
1900	Eternal Rye	B	Winter rye	1	NPK	5	1995	14.06.1995	Chemical care	Macasal	1.5	l/ha
1901	Eternal Rye	B	Winter rye	1	NPK	5	1995	31.07.1995	Harvest			
1902	Eternal Rye	B	Winter rye	1	NPK+FM	7	1995	12.08.1994	Soil cultivation			
1903	Eternal Rye	B	Winter rye	1	NPK+FM	7	1995	20.09.1994	Soil cultivation			
1904	Eternal Rye	B	Winter rye	1	NPK+FM	7	1995	28.09.1994	Soil cultivation	Plowing	25	cm
1905	Eternal Rye	B	Winter rye	1	NPK+FM	7	1995	05.10.1994	Soil cultivation	Seedbed preparation		
1906	Eternal Rye	B	Winter rye	1	NPK+FM	7	1995	07.10.1994	Sowing	Variety Amando		
1907	Eternal Rye	B	Winter rye	1	NPK+FM	7	1995	07.10.1994	Sowing	Seed rate	126	kg/ha
1908	Eternal Rye	B	Winter rye	1	NPK+FM	7	1995	07.10.1994	Sowing	Row width	12.5	cm
1909	Eternal Rye	B	Winter rye	1	NPK+FM	7	1995	27.09.1994	Fertilization	P		
1910	Eternal Rye	B	Winter rye	1	NPK+FM	7	1995	27.09.1994	Fertilization	K		
1911	Eternal Rye	B	Winter rye	1	NPK+FM	7	1995	06.10.1994	Fertilization	N		

Datenpublikation „Ewiger Roggen“: Ertragsdaten + Bodendaten



Ertragsdaten: https://doi.org/10.5281/zenodo.17948934 Bodendaten: https://doi.org/10.5281/zenodo.20282058

Möglichkeiten für zukünftige Forschungsinitiativen

Prof. Dr. habil. Janna Macholdt

Dauerfeldversuche als wertvoller Datenschatz

Langzeitgedächtnis des Bodens & Grundlage für Ausbildung und Wissenstransfer