

Nutrients recovery in agricultural residual streams - manure, digestate and surfacewater



Techniques, process chains, adjustment possibilities

Stickstoffaufbringung aus organischen und organisch-mineralischen Düngemitteln gemäß § 6 Abs. 4 DüV

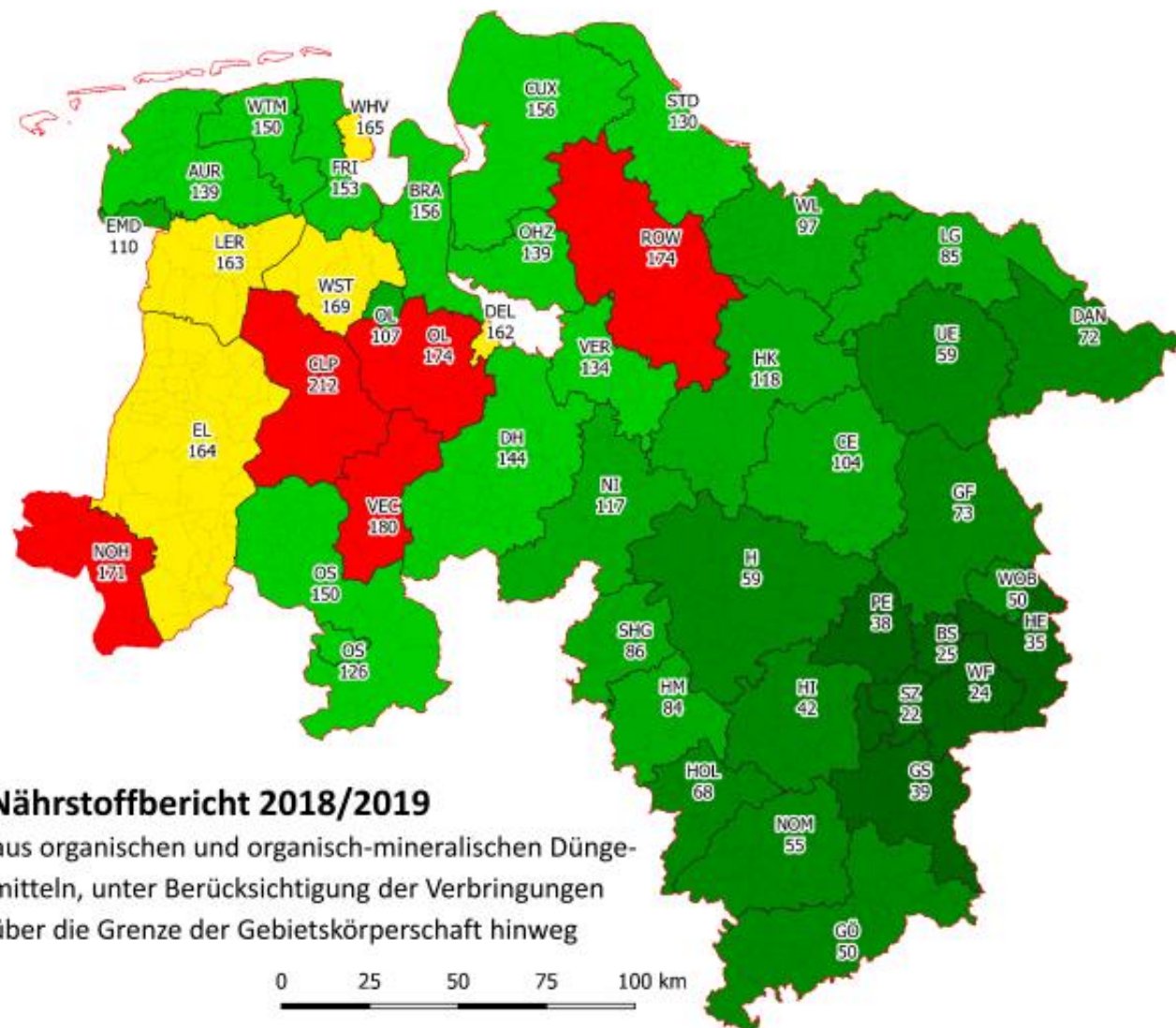
Stickstoffüberschuss nach § 6 (4)
DüV* oberhalb von 170 kg N/ha
absolut (rote Färbung):

Fläche LF nach § 6 (4) DüV:
= **412.691 ha (ohne Brache)**
zulässige Aufbringung:
= **70.157 t N**
aufgebrachte N-Menge:
= **75.693 t N**
N-Überschuss > 170 kg N/ha:
= **5.536 t N**

Durchschnittswerte auf
Regionsebene:

Braunschweig: 47 kg N/ha
Leine-Weser: 93 kg N/ha
Lüneburg: 123 kg N/ha
Weser-Ems: 165 kg N/ha

Landesebene: 121 kg N/ha



Phosphatsalden gemäß den Vorgaben des § 9 Abs. 3 Düngungsverordnung aus organischer Düngung in kg P₂O₅/ha LF WD

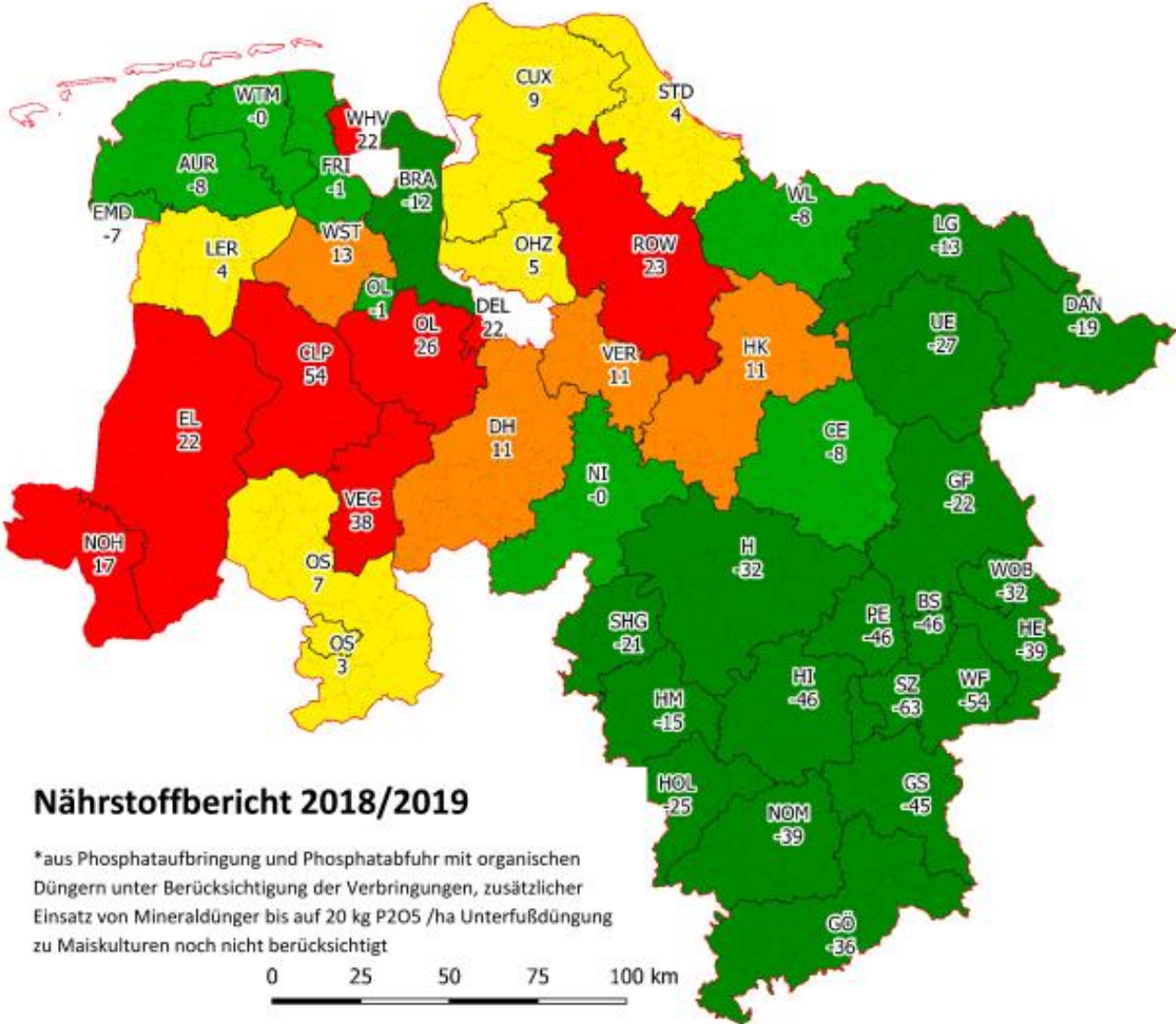
8 Landkreise / kreisfreie Städte mit
Überschreitung des aktuellen
Kontrollwertes von **17 kg P₂O₅/ha**
(siehe rote Färbung >17 kg P₂O₅/ha)

Phosphatüberschuss oberhalb des
Kontrollwertes von
17 kg P₂O₅/ha: rd. **6.999 t P₂O₅**

Phosphatsaldo landesweit auf
Grundlage der P-Abfuhr insgesamt: -
6.526 t P₂O₅

ohne mineralische Unter-
fußdüngung zu Mais:
-18.472 t P₂O₅/ha

P-Reserve aus P-Überschüssen in den
Landkreisen oberhalb der Abfuhr (> 0
kg P₂O₅/ha)
rd. **14.280 t P₂O₅**



§9 (3) DüV kg P₂O₅ / ha

- < -10
- 10 bis 0
- 0 bis 10
- 10 bis 17
- > 17

adjustment possibilities for a surplus of nutrients

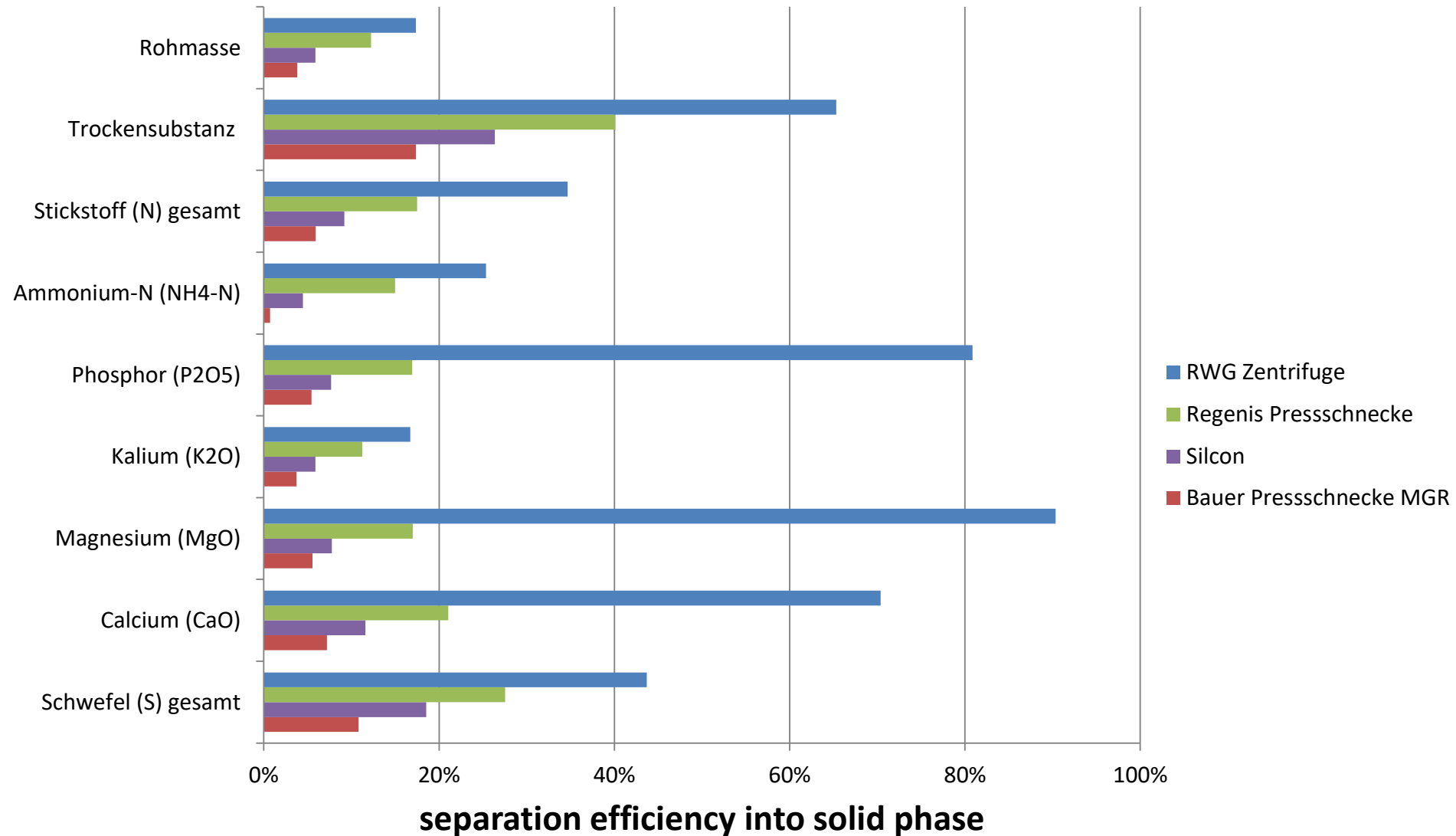


- Storage, processing, optimisation of fermentation process
- Feeding strategies for biogas plants: District Emsland high energy input, district Rotenburg (Wümme) uses more manure
- Simple screwpresses up to complete treatment
- Practical solutions:
Test – implement – optimise

separation efficiency



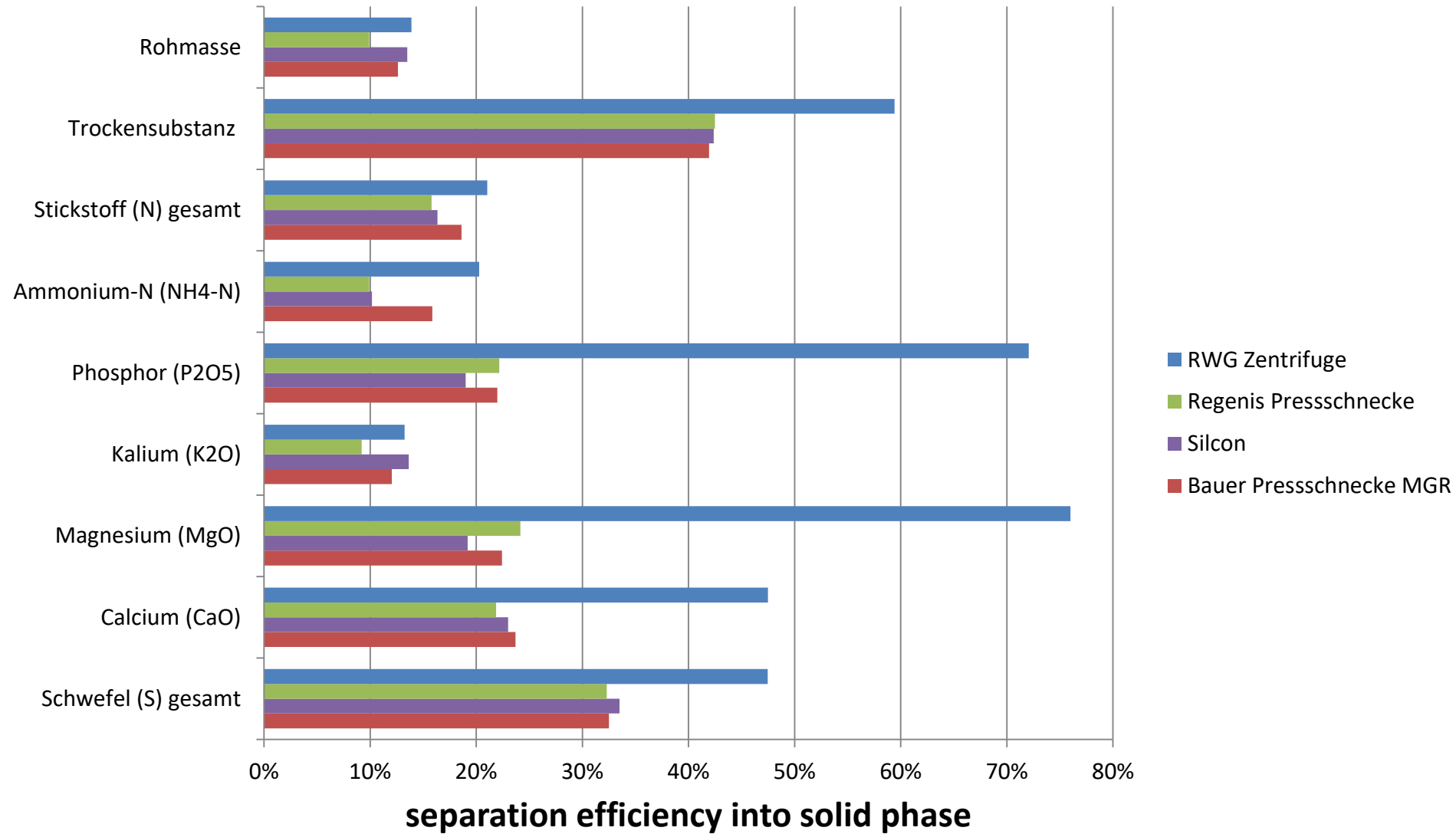
Pig Manure



separation efficiency



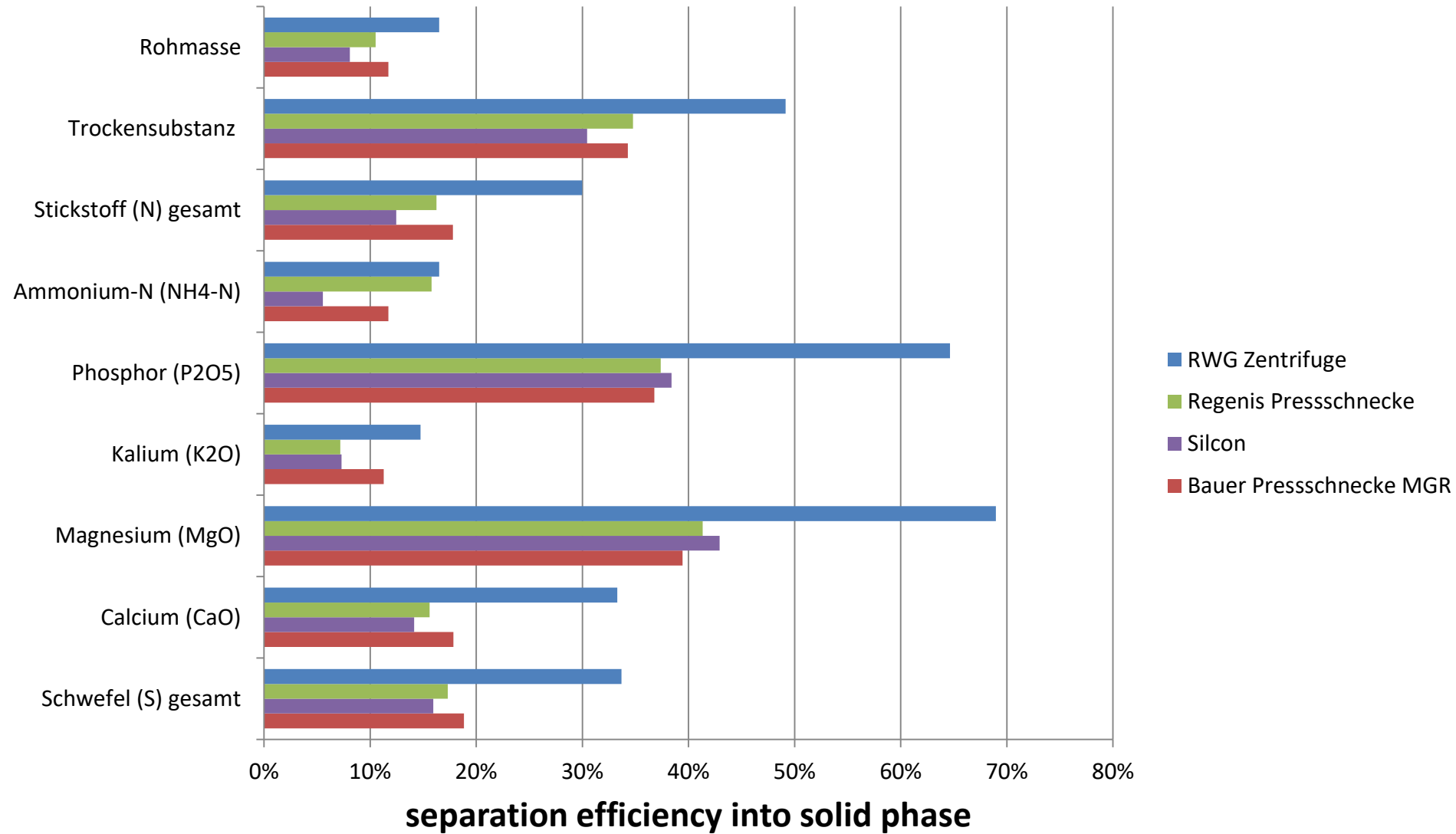
Cow Manure



separation efficiency



Digestate



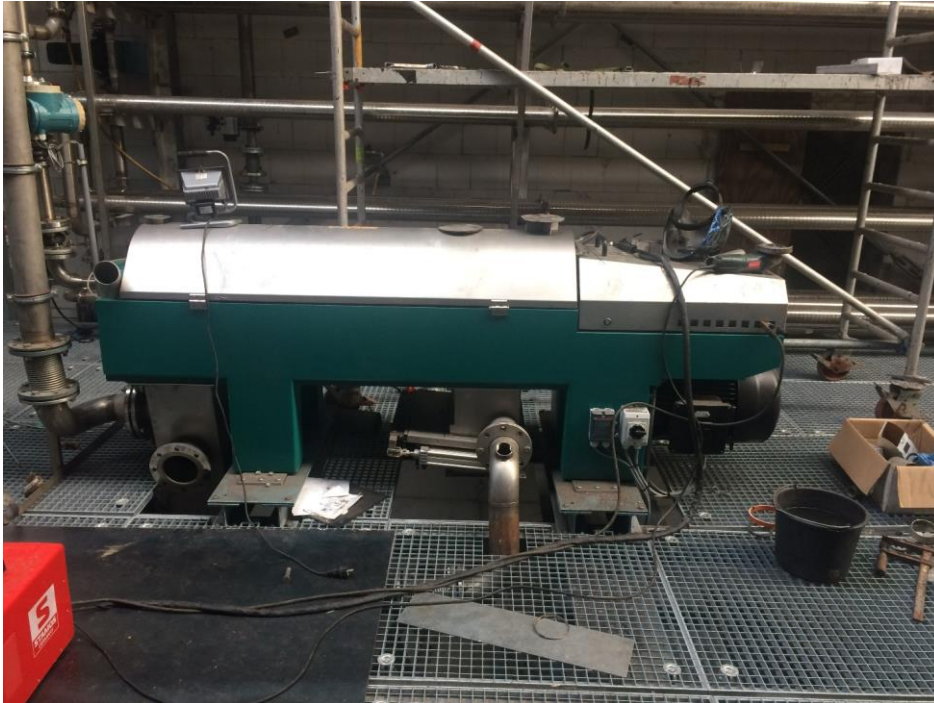
Complete processing of digestate



reed beds



Screwpress, dryer, centrifuge, ASL



Ammonia-sulphate-dissolution 3N⁹

- Recognition of Ammonia-sulphate-dissolution as Mineral fertilizer
- Requirement from authority:
 - Min. 5% $\text{NH}_4\text{-H}$
 - Min. 6% watersoluble sulphate
- Results of analysis (LUFA Oldenburg)



Institut für Düngemittel und Saatgut **LUFA**
NORD-WEST

LUFA - Postfach 55 06 55 - 31756 Hameln

3N Kompetenzzentrum e.V.
Sascha Hermus
Kompetenzstraße 1
49757 Werthe

Prüfbericht

Auftrags-Nr.: -
Labor-Nr.: DD 1901959
Seite 1 von 1

Hameln, 03.07.2018 /w
Auskunft: Dr. Inge Paradies-Severin
Telefon: 051519871-53

Bezeichnung: 001 Ammoniumsulfat Lösung ASL BB
(nach Angabe des Herstellers)
Typ/Menge: Projekt: Grüne Kaskade
237 g incl. Verp.
Eingangsdatum: 22.06.2018
Beginn der Prüfung: 22.06.2018
Ende der Prüfung: 03.07.2018
Datum der Herstellung:

Verpackung: Polygefäß
Probennahmebericht-Nr.:
Probennahmer: Janik Faustmann
(Ph.D. Auftraggeber)

der Lieferung: 18.06.2018
der Probennahme: Janik Faustmann, Christian-Abrecht-Universität, Kol. Am. Gärten
Durchschnitt an: Garten 5, 24118 Kiel

Befund in der Originalsubstanz

Gesamt-Stickstoff	6,47	%
Methode: VDLUFA II, 3.5.2.7		
Schwefel	7,62	%
Methode: ISO 11885, E 22		

Bemerkungen:

Dr. Inge Paradies-Severin
(Laborleiterin)

Umschreibung: 1 % = 10.000 mg/kg

3N - 9 ist ein Markenname für die nachfolgenden unter (Name des Arbeitstitels):
#1 = LUFA Standard 01, #2 = LUFA Standard 02, #3 = LUFA Standard 03, #4 = LUFA Standard 04, #5 = LUFA Standard 05, #6 = LUFA Standard 06, #7 = LUFA Standard 07, #8 = LUFA Standard 08, #9 = LUFA Standard 09, #10 = LUFA Standard 10, #11 = LUFA Standard 11, #12 = LUFA Standard 12, #13 = LUFA Standard 13, #14 = LUFA Standard 14, #15 = LUFA Standard 15, #16 = LUFA Standard 16, #17 = LUFA Standard 17, #18 = LUFA Standard 18, #19 = LUFA Standard 19, #20 = LUFA Standard 20, #21 = LUFA Standard 21, #22 = LUFA Standard 22, #23 = LUFA Standard 23, #24 = LUFA Standard 24, #25 = LUFA Standard 25, #26 = LUFA Standard 26, #27 = LUFA Standard 27, #28 = LUFA Standard 28, #29 = LUFA Standard 29, #30 = LUFA Standard 30, #31 = LUFA Standard 31, #32 = LUFA Standard 32, #33 = LUFA Standard 33, #34 = LUFA Standard 34, #35 = LUFA Standard 35, #36 = LUFA Standard 36, #37 = LUFA Standard 37, #38 = LUFA Standard 38, #39 = LUFA Standard 39, #40 = LUFA Standard 40, #41 = LUFA Standard 41, #42 = LUFA Standard 42, #43 = LUFA Standard 43, #44 = LUFA Standard 44, #45 = LUFA Standard 45, #46 = LUFA Standard 46, #47 = LUFA Standard 47, #48 = LUFA Standard 48, #49 = LUFA Standard 49, #50 = LUFA Standard 50, #51 = LUFA Standard 51, #52 = LUFA Standard 52, #53 = LUFA Standard 53, #54 = LUFA Standard 54, #55 = LUFA Standard 55, #56 = LUFA Standard 56, #57 = LUFA Standard 57, #58 = LUFA Standard 58, #59 = LUFA Standard 59, #60 = LUFA Standard 60, #61 = LUFA Standard 61, #62 = LUFA Standard 62, #63 = LUFA Standard 63, #64 = LUFA Standard 64, #65 = LUFA Standard 65, #66 = LUFA Standard 66, #67 = LUFA Standard 67, #68 = LUFA Standard 68, #69 = LUFA Standard 69, #70 = LUFA Standard 70, #71 = LUFA Standard 71, #72 = LUFA Standard 72, #73 = LUFA Standard 73, #74 = LUFA Standard 74, #75 = LUFA Standard 75, #76 = LUFA Standard 76, #77 = LUFA Standard 77, #78 = LUFA Standard 78, #79 = LUFA Standard 79, #80 = LUFA Standard 80, #81 = LUFA Standard 81, #82 = LUFA Standard 82, #83 = LUFA Standard 83, #84 = LUFA Standard 84, #85 = LUFA Standard 85, #86 = LUFA Standard 86, #87 = LUFA Standard 87, #88 = LUFA Standard 88, #89 = LUFA Standard 89, #90 = LUFA Standard 90, #91 = LUFA Standard 91, #92 = LUFA Standard 92, #93 = LUFA Standard 93, #94 = LUFA Standard 94, #95 = LUFA Standard 95, #96 = LUFA Standard 96, #97 = LUFA Standard 97, #98 = LUFA Standard 98, #99 = LUFA Standard 99, #100 = LUFA Standard 100.

LUFA Nord-West, Dr. Inge Paradies-Severin, Landeshauptstadt Oldenburg, 26123 Oldenburg, Oldenburg 23.07.187, Oldenburg, Nr. 58 245 610 244

Requirements met

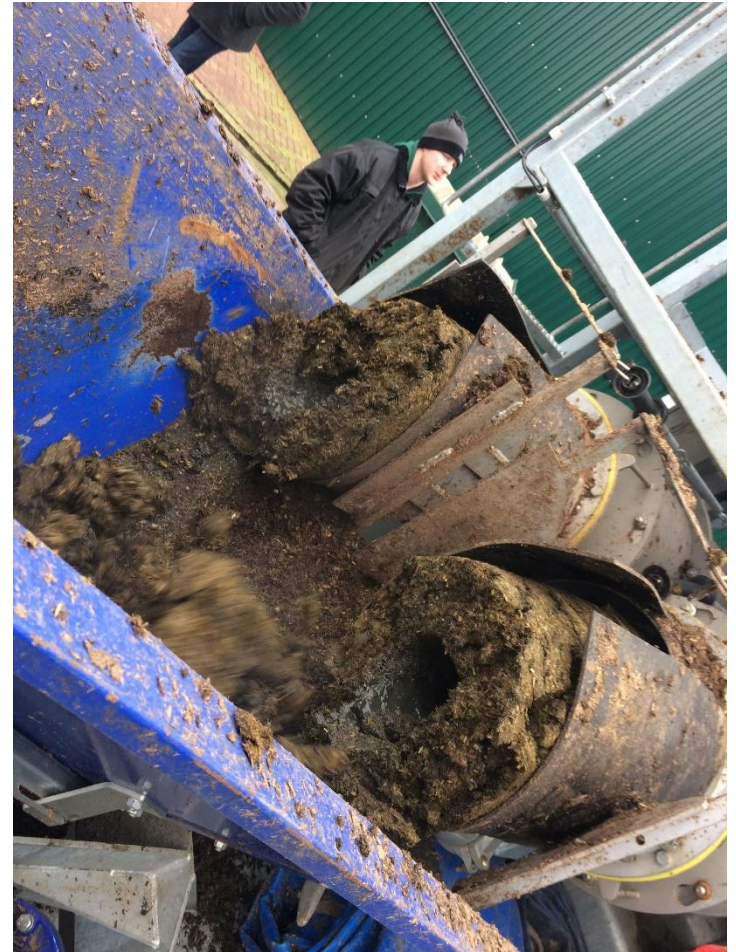
Screwpress, dryer, centrifuge, ASL



Mobile centrifuge/Screwpresses on demonstrations days

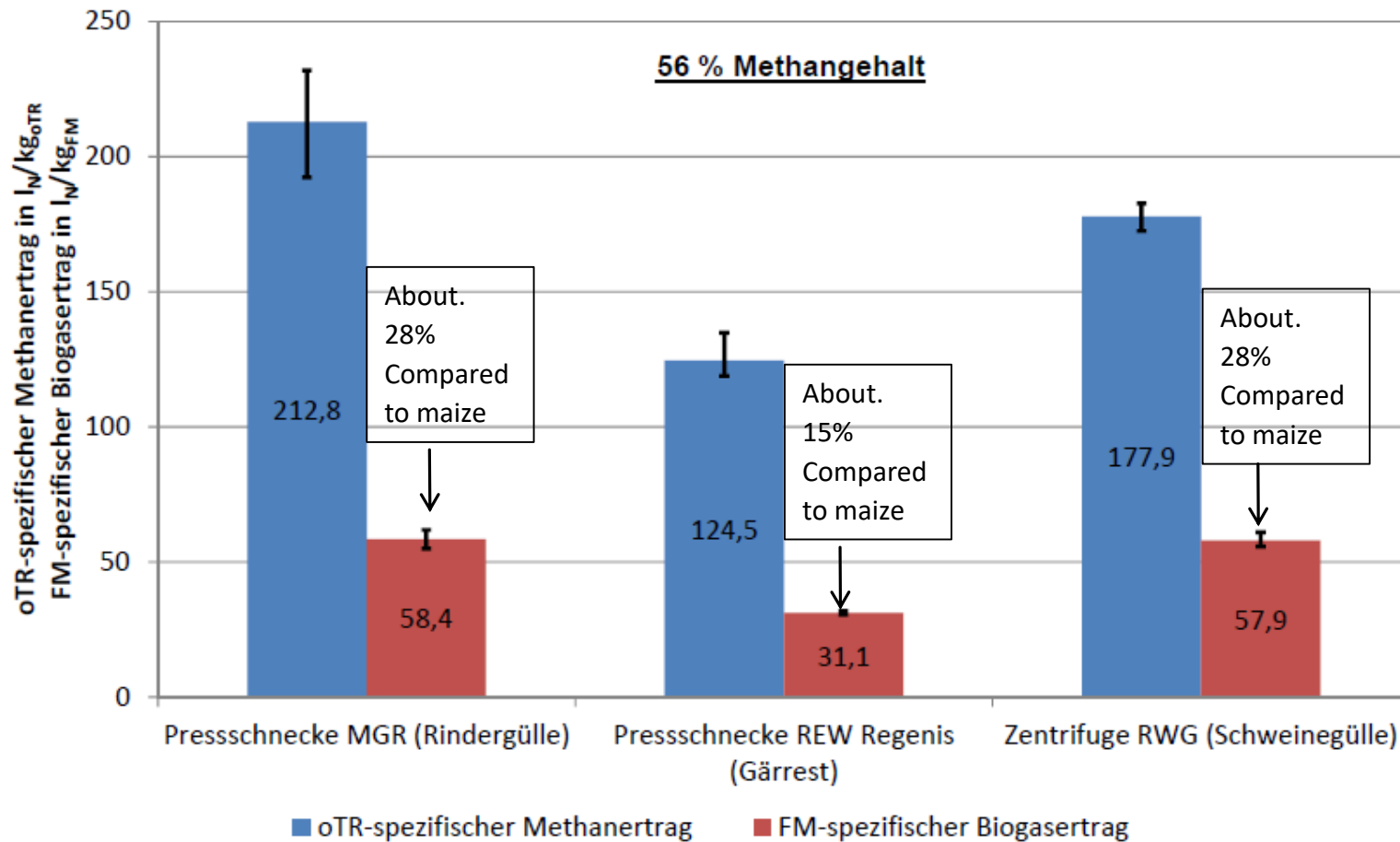


Mobile centrifuge/Screwpresses on demonstrations days



Biogaspotential

Compared to maize with regard to LfL: 350 NI CH₄/kg oDM, Biogasyield about 210 NI with 52% CH₄ /t FM



Substratequantities in Biogasplants and greenhouse gas reductions – today and tomorrow-

Input 2018	Amounts		Proportion on electrical power	CO ₂ -reduction	
	(Mio. t)	%		(Mio. t)	%
agricultural residues like slurry, solid manure, digestate	7,8	34,5	11,0	0,9	11,1
Energy crop and plant based by-products	13,3	58,4	82,0	2,5	81,9
Organic waste (Fats, Flotates, biological waste)	1,6	7,1	7,0	0,3	7,0
In total	22,7	100	100	3,7	100

Input 2025	Amounts		Proportion on electrical power	CO ₂ -reduction	
	(Mio. t)	%		(Mio. t)	%
agricultural residues like slurry, solid manure, digestate	42,4	91,6	76	4,90	84,5
Energy crop and plant based by-products	2,2	4,8	13	0,53	9,5
Organic waste (Fats, Flotates, biological waste)	1,7	3,6	6	0,35	6,0
In total	46,3	100	100	5,78	100

Phosphatsalden gemäß den Vorgaben des § 9 Abs. 3 Düngungsverordnung aus organischer Düngung in kg P₂O₅/ha LF WD

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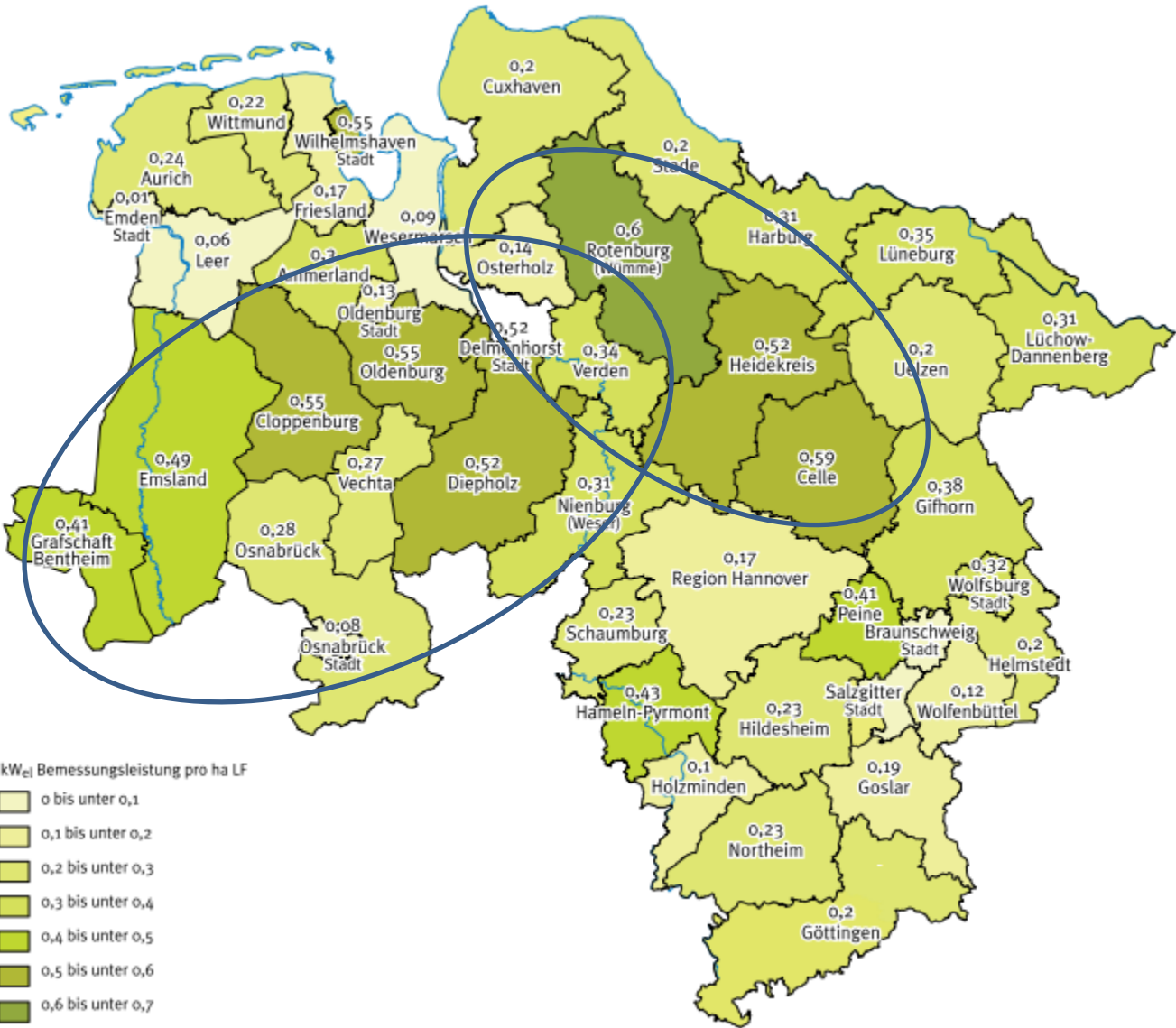


Abb. 13: NawaRo-Bioqasanlagen – Elektrische Bemessungsleistung in kW pro Hektar LF in Niedersachsen, 2018

Aim of usage:

1. Reduction of nutrient concentrations in residues of biogas production and of livestock farming
This includes: Surface water, Condensate water, digestate (after steps of separation)
2. Products of commercial value:
 - Pet-Food
 - Cosmetics
3. Closing of (nutrient) cycles

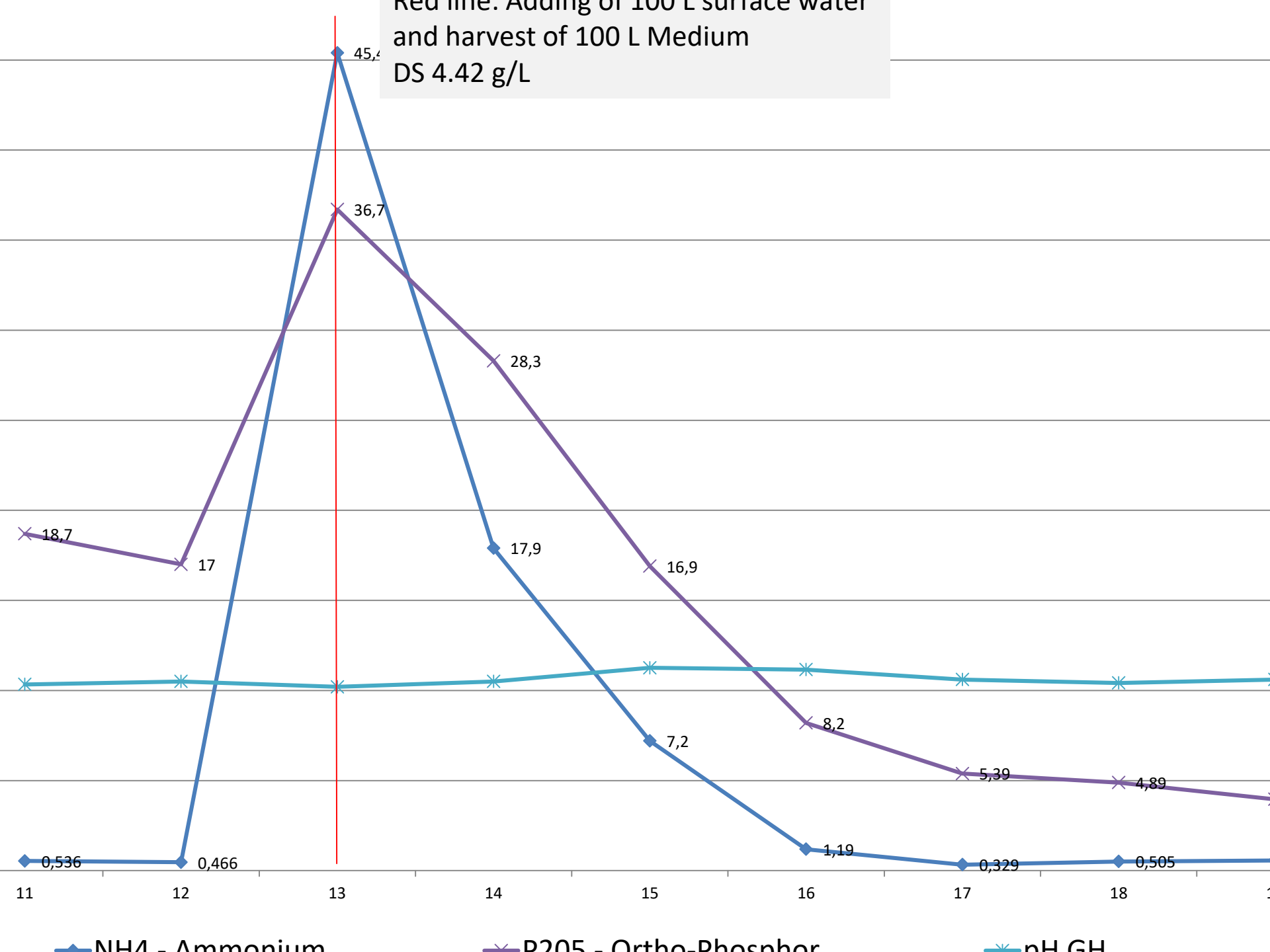
Nutrient uptake of *Spirulina sp.*



LGem-photobioreactor with 1m³ usable volume



Red line: Adding of 100 L surface water
and harvest of 100 L Medium
DS 4.42 g/L



Mobile Photobioreactor



- Pilotreactor from company Limnosystem
- Tubes-Photobioreactor
- Length of tubes: 38m
- About 900L volume

Used Algae: *Scenedesmus*, but selected „by hand“ with regard of fast sedimentation

Mobile Photobioreactor

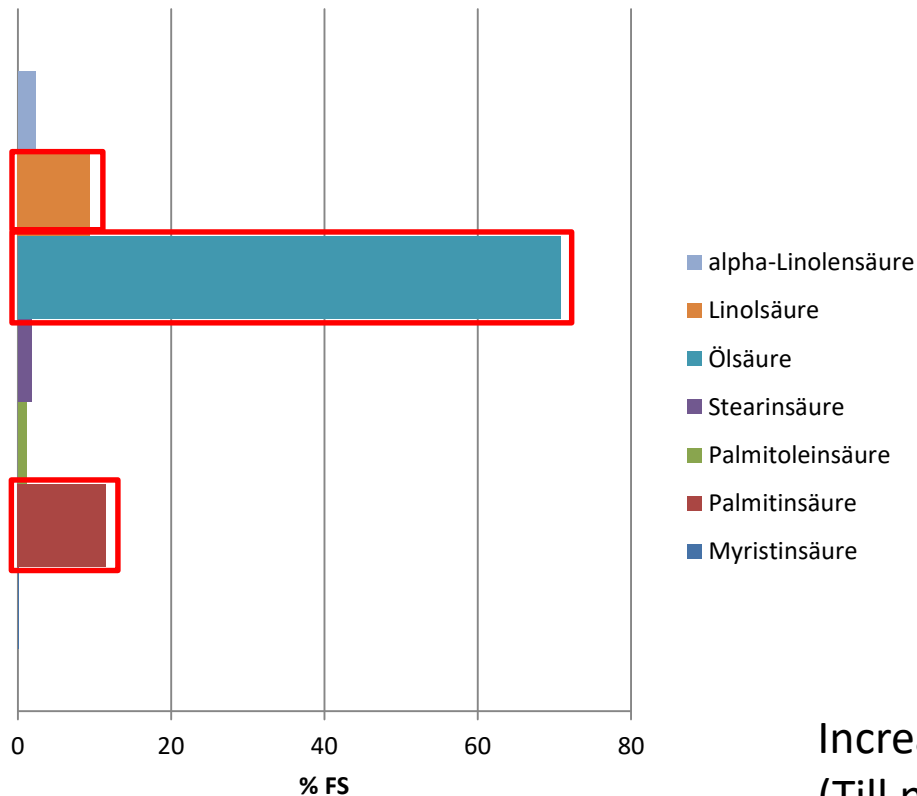
-owned and used by 3N and Botanical Garden, CAU Kiel-



Sedimentation ability of algal biomass



Spectrum of fatty acids



- Small proportion of Omega-3

- High proportion of fatty acids , interesting for cosmetics

Increase of whole proportion of fatty acids necessary
(Till now: 4% of whole weight)



Thank you very much
for your attention.

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