Using UAS and remote sensing in Danish national trials

The 4th Annual – Nordic Plant Phenotyping Network Workshop, November 22nd – 23rd, 2018

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Biomass measurements from drone and satellite

- Farmers union trials
- Biomass measurements in trials
- Measurement from satellite and use in farming

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Field trials organised by SEGES

- 1000 trials per year
  - Variety trials = 400
  - Fertilizer trials = 240
  - Plant Protection = 260
  - Miscellaneous = 100
- Results published in December
- Distributed between 13 local trial units

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Raw data is published online in the season

Nordic Field Trial System Version: 1.0.0.19423

LOGIN

Forsøgsdokumentation

Til Oversigt

011051515-001. Vårbygsorter, A og B sorter

Resultater fra Landsforsøgene må kun anvendes under særlige betingelser – læs her

Forsøgets placering

Forsøgsvært:

Ove Ehlersen

Kastedvej 17

8381, Mundelstrup

Tlf: 86245499/40433751

Email:

Forsøgsansvarlig:

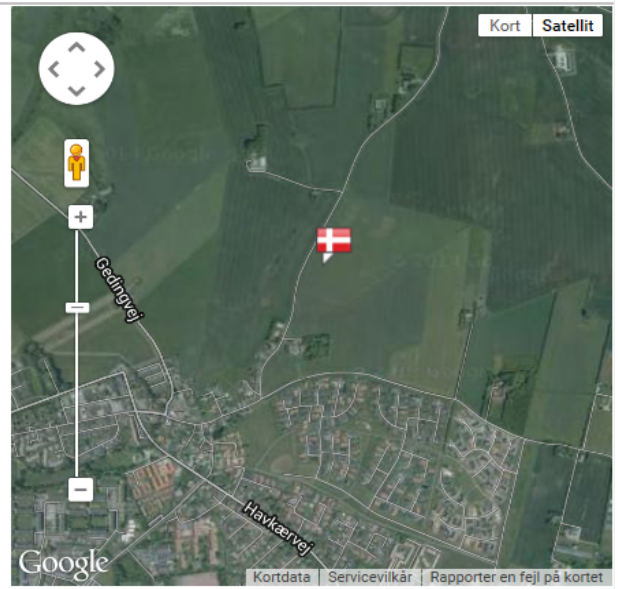
Torben Pedersen

Agro Food Park 0

8200 Århus N

Tlf: 8743 8497 / 2045 3172

Email: tep@agrotech.dk



Konsulentnummer: 1417

Placeringsgruppering: Østjylland

Placering:

Utm Zone: 32

Easting: 569.472 m

Northing: 6.228.656 m

Gps: 56.1977763227044, 10.119659480891

Kommune:

Eksporter enkeltforsøgsdata til XML
Komprimeret dokumentation
Forsøgsdesign og randomiseringsplan

Grundoplysninger

Afgrøde: Vårbyg. Forfrugt: Vårbyg.

Forsøgstype: Alpha-design, 1 faktor. Antal gentagelser: 4. Antal rækker: 4.

Grundbehandlinger

Dato	Mgd/ha	Kategori	Middel	Total N/ha	P/ha	K/ha	Bl	Omfang
10-04-2015		Udsæd og såning	Så-dato, hovedafgrøde					Både mark og forsøg
10-04-2015	550 kg	Handelsgødninger	NPK 21-3-10 m Mg S B	113,3	14,3	52,8		Kun forsøg
18-05-2015	0,6 l	Herbicider	Tomahawk 180 EC				0,86	Både mark og forsøg
18-05-2015	15 g		Ally SX				0,75	Både mark og forsøg
04-06-2015	0,2 l	Fungicider	Prosaro EC 250				0,22	Både mark og forsøg

110%

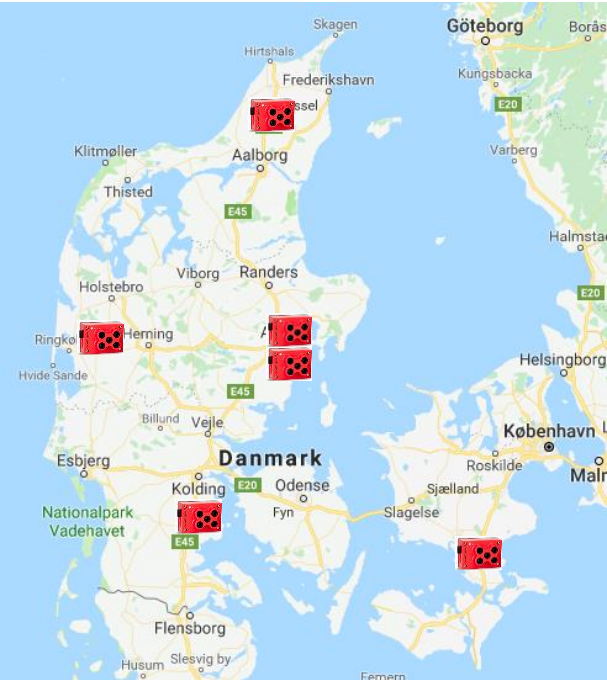
Biomass measurements from drone with multispectral camera

Micasense, RedEdge-M

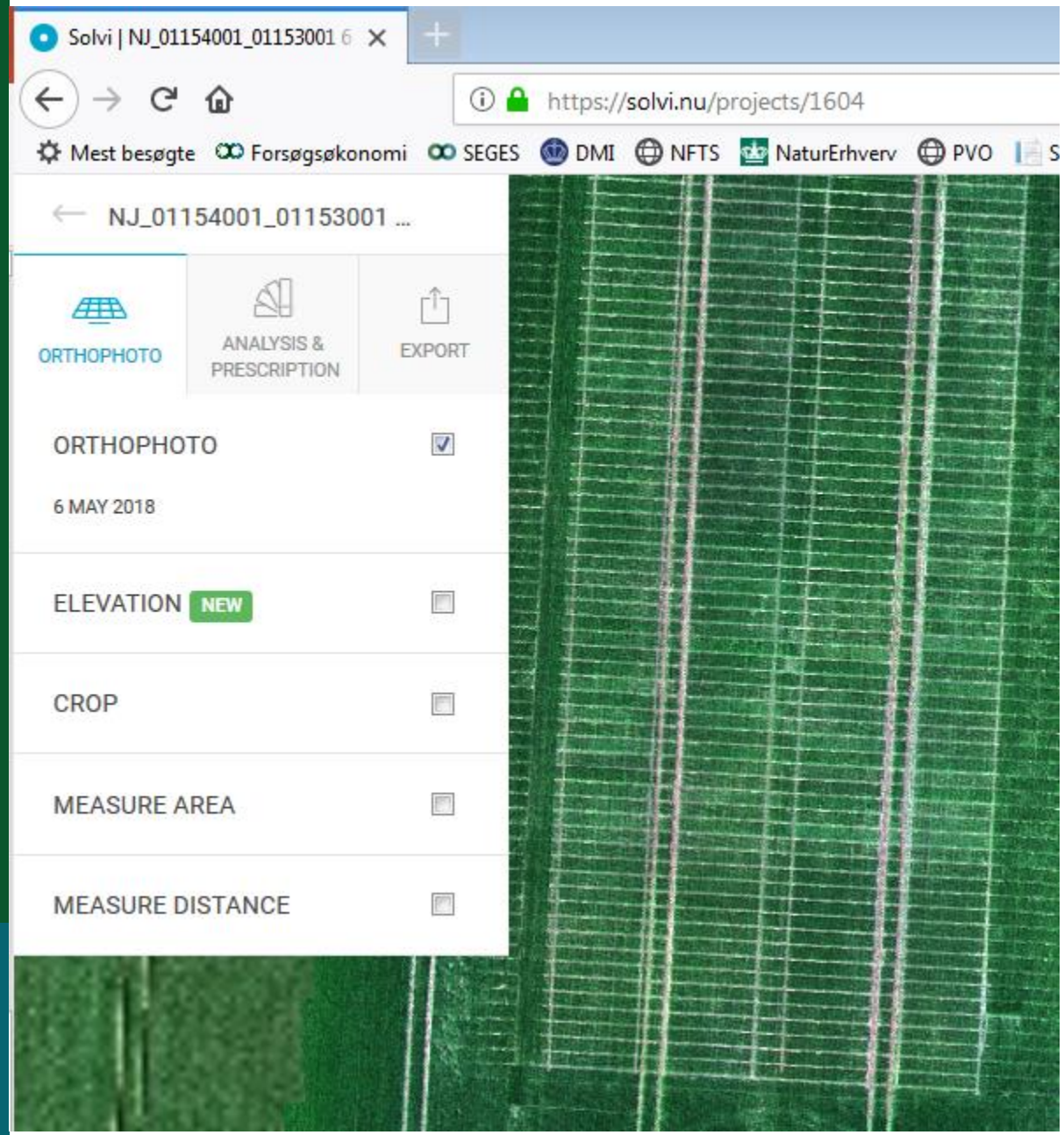
Band Number	Band Name	Center Wavelength (nm)	Bandwidth FWHM (nm)
1	Blue	475	20
2	Green	560	20
3	Red	668	10
4	Near IR	840	40
5	Red Edge	717	10

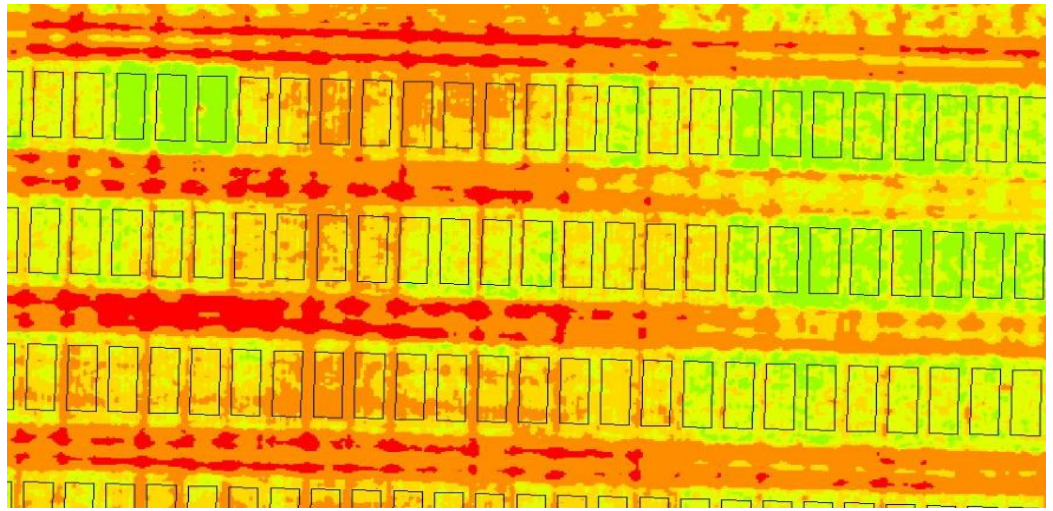
$$NDVI = \frac{NIR - Rød}{NIR + Rød}$$

$$NDRE = \frac{NIR - RedEdge}{NIR + RedEdge}$$



Biomass measurements from drone





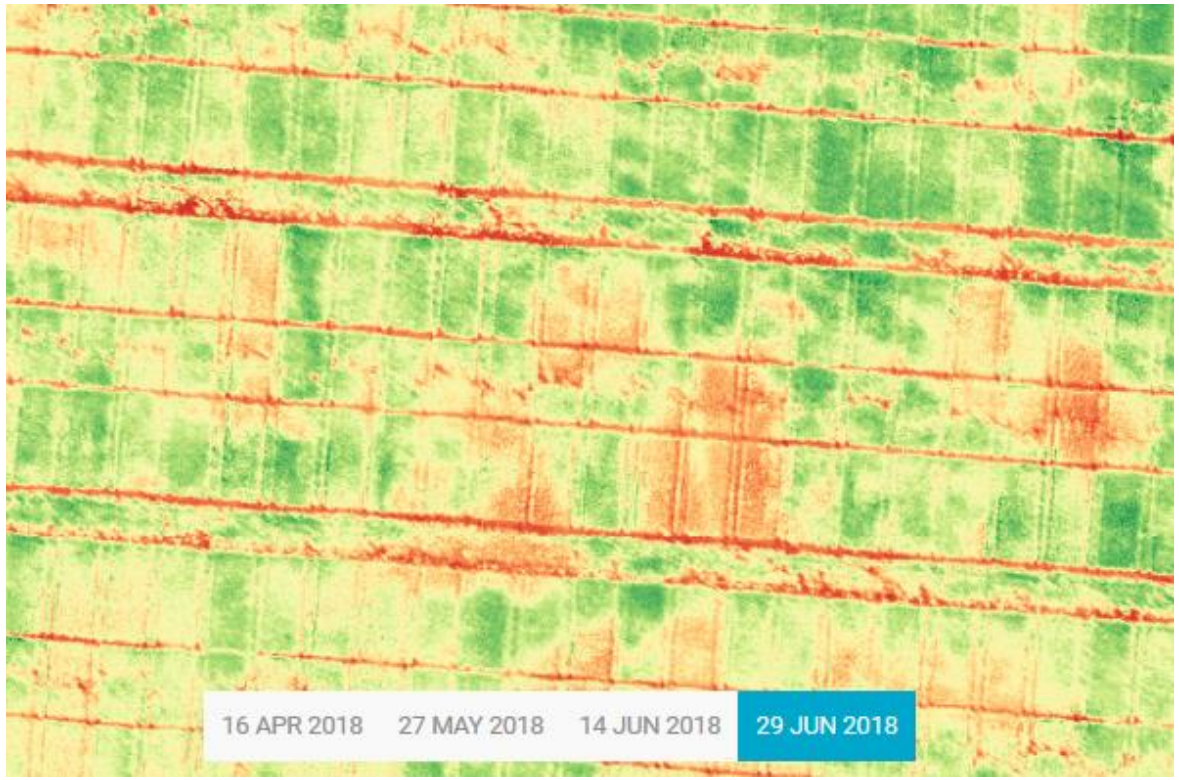
Observerede rå-data og modelkontrol

			P06: 25-11-2017 ST. NDVI-REFLEKTANS værdi	Nedre konf.	Øvre konf. int.	Signifikansgruppe
I	A	1	0,32568	0,3	0,4	ab
		2	0,24864	0,2	0,3	ce
		3	0,33922	0,3	0,4	a
	B	1	0,15869	0,1	0,2	gi
		2	0,20258	0,2	0,2	fh
		3	0,20881	0,2	0,3	dfh
II	A	1	0,26853	0,2	0,3	bcd
		2	0,35225	0,3	0,4	a
		3	0,34672	0,3	0,4	a
	B	1	0,18428	0,1	0,2	hi
		2	0,22681	0,2	0,3	ef
		3	0,22035	0,2	0,3	efg

LSD

Måletid	Dato	Måling af	
P06	25-11-2017	NDVI-REFLEKTANS, værdi	lsd1=0,01384 p1=0 lsd2=0,02478 p2=3E-05 ls p123=2E-05


16 APR 2018
27 MAY 2018
14 JUN 2018
29 JUN 2018


16 APR 2018
27 MAY 2018
14 JUN 2018
29 JUN 2018

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Application in trials

- Documentation of the trial
- Compare growth of different varieties:
  - Autumn growth
  - Speed of early spring growth
  - Earliness
- Nitrogen uptake
- Yield estimates

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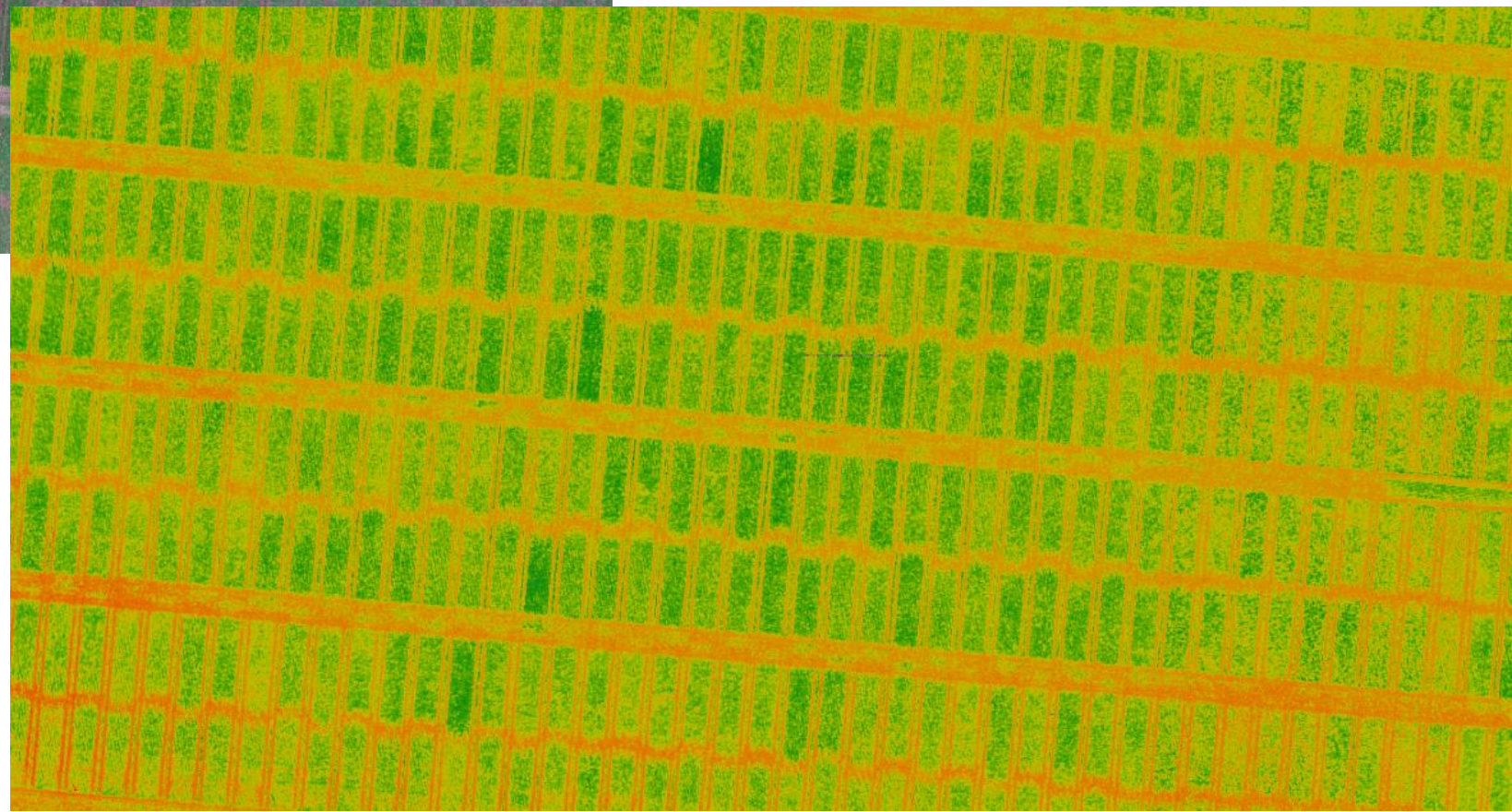
Winter wheat varieties
1. december 2017



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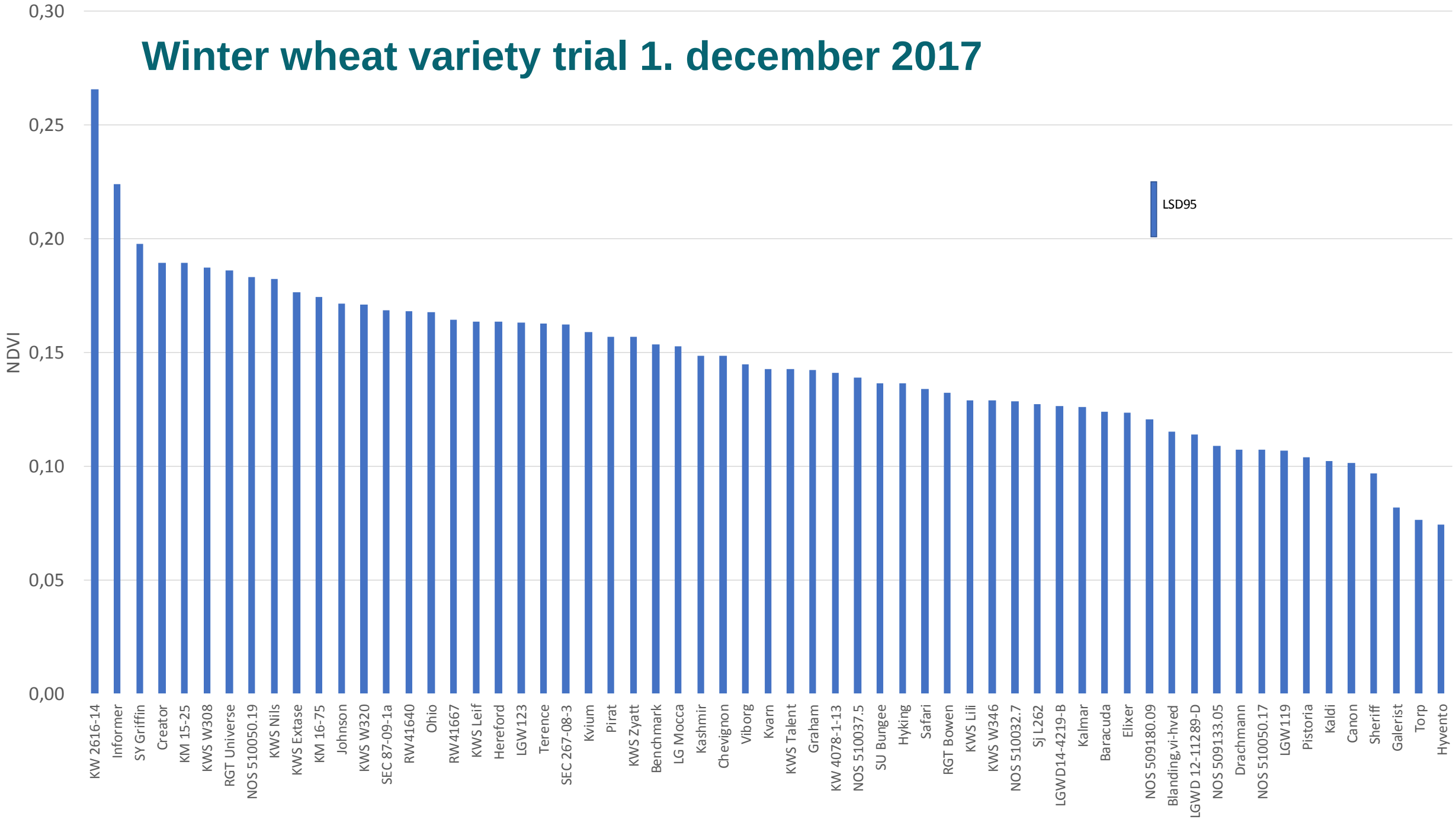
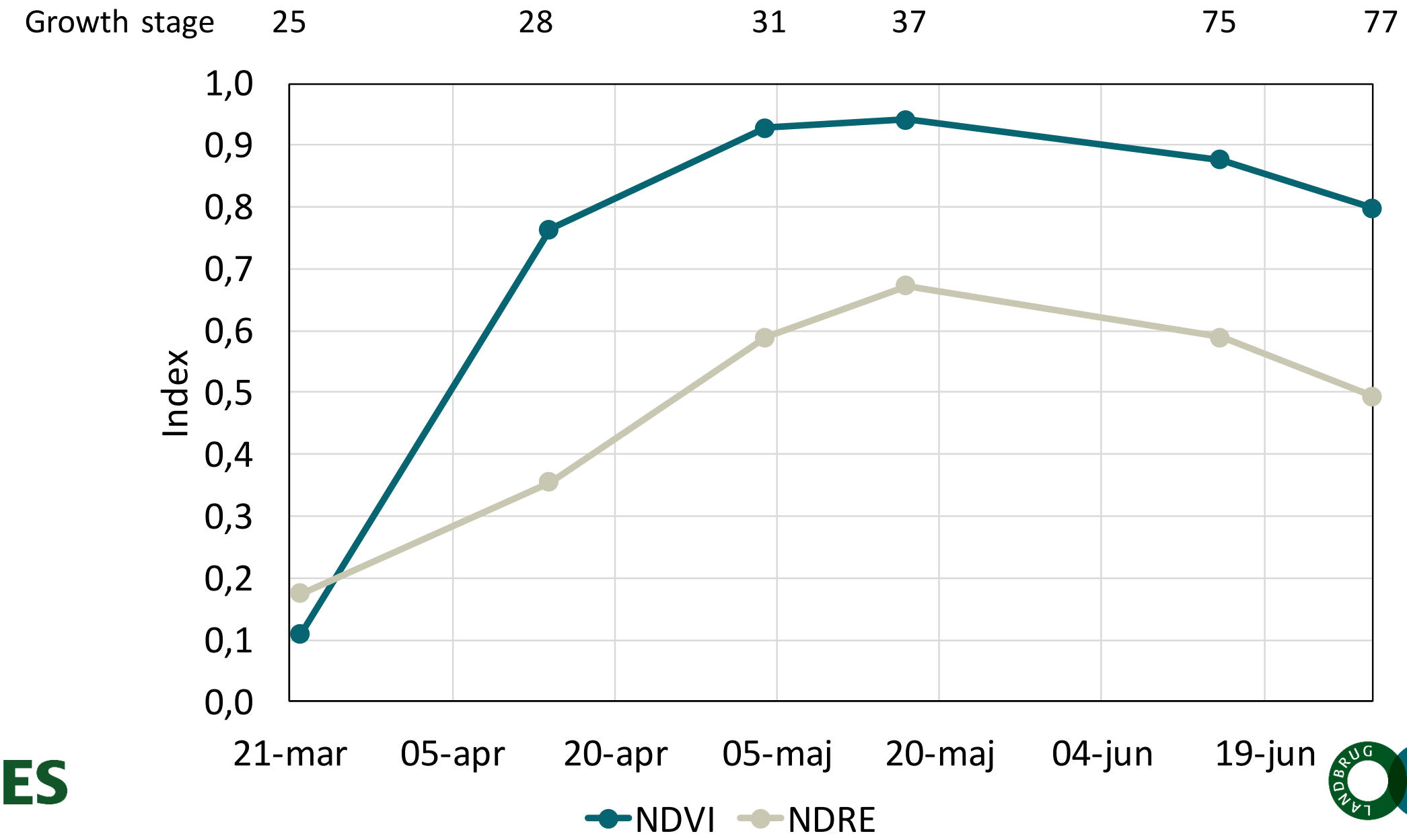
Winter wheat variety trial 1. december 2017



Vegetation index NDVI or NDRE, winter wheat



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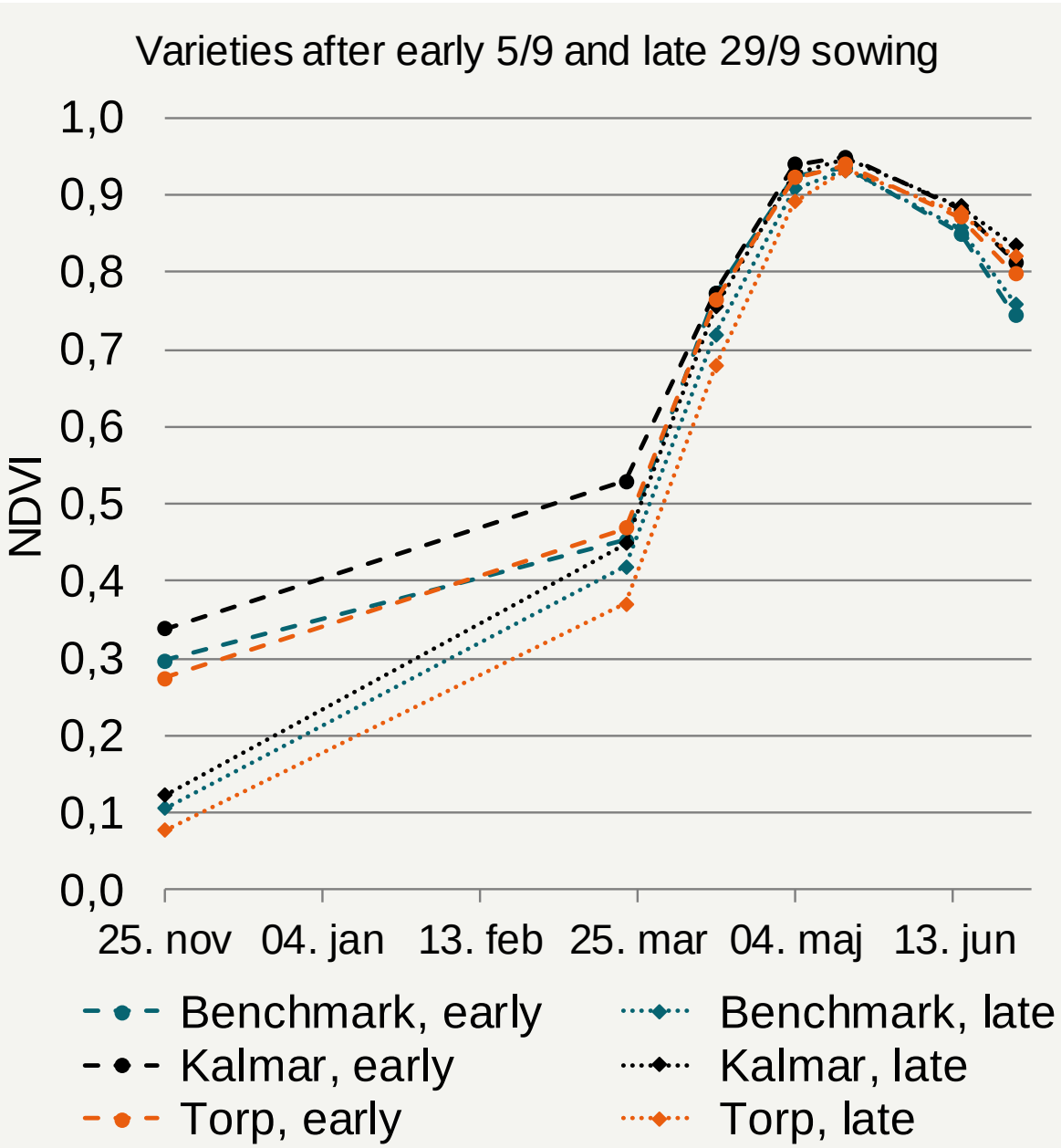
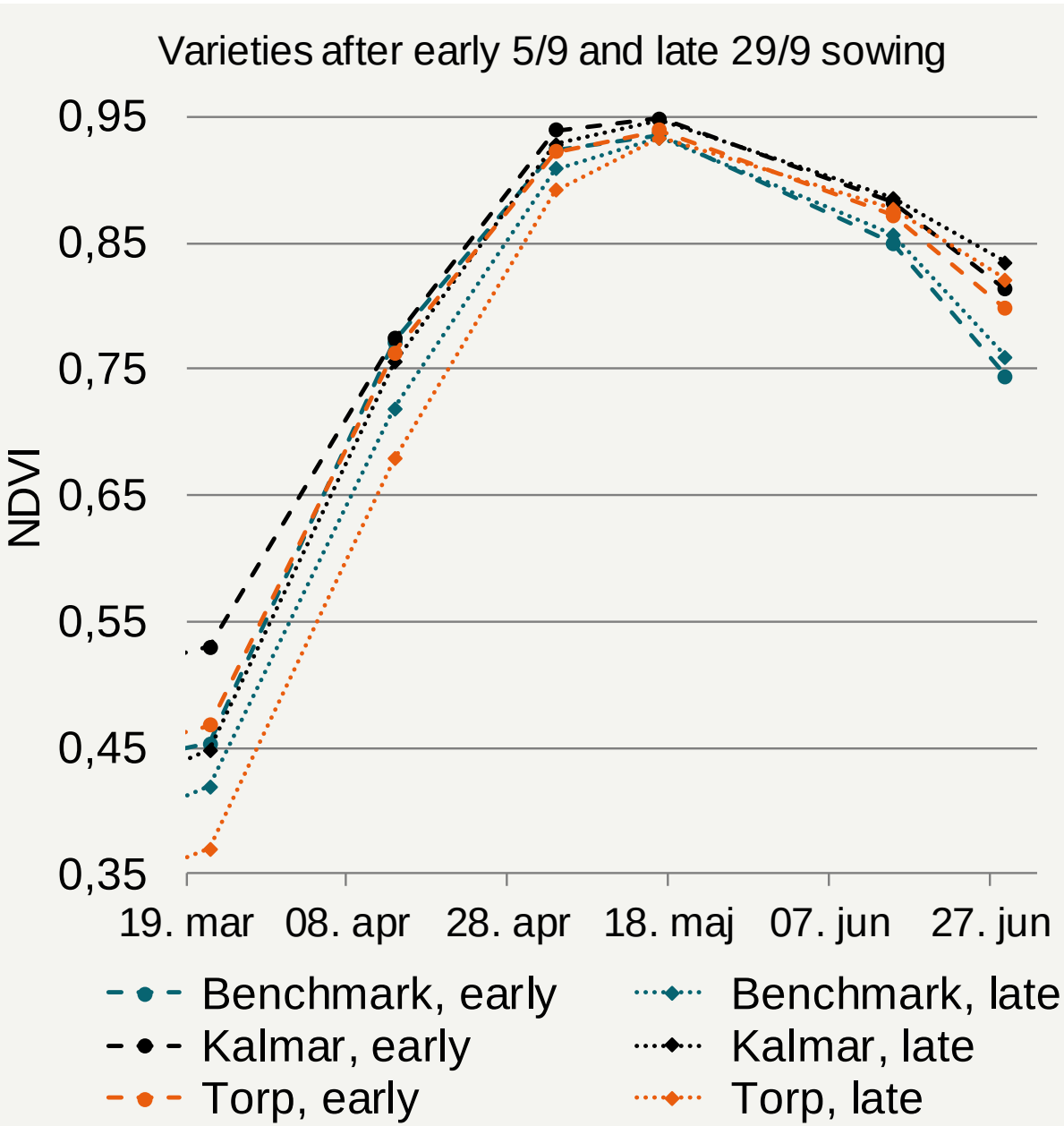
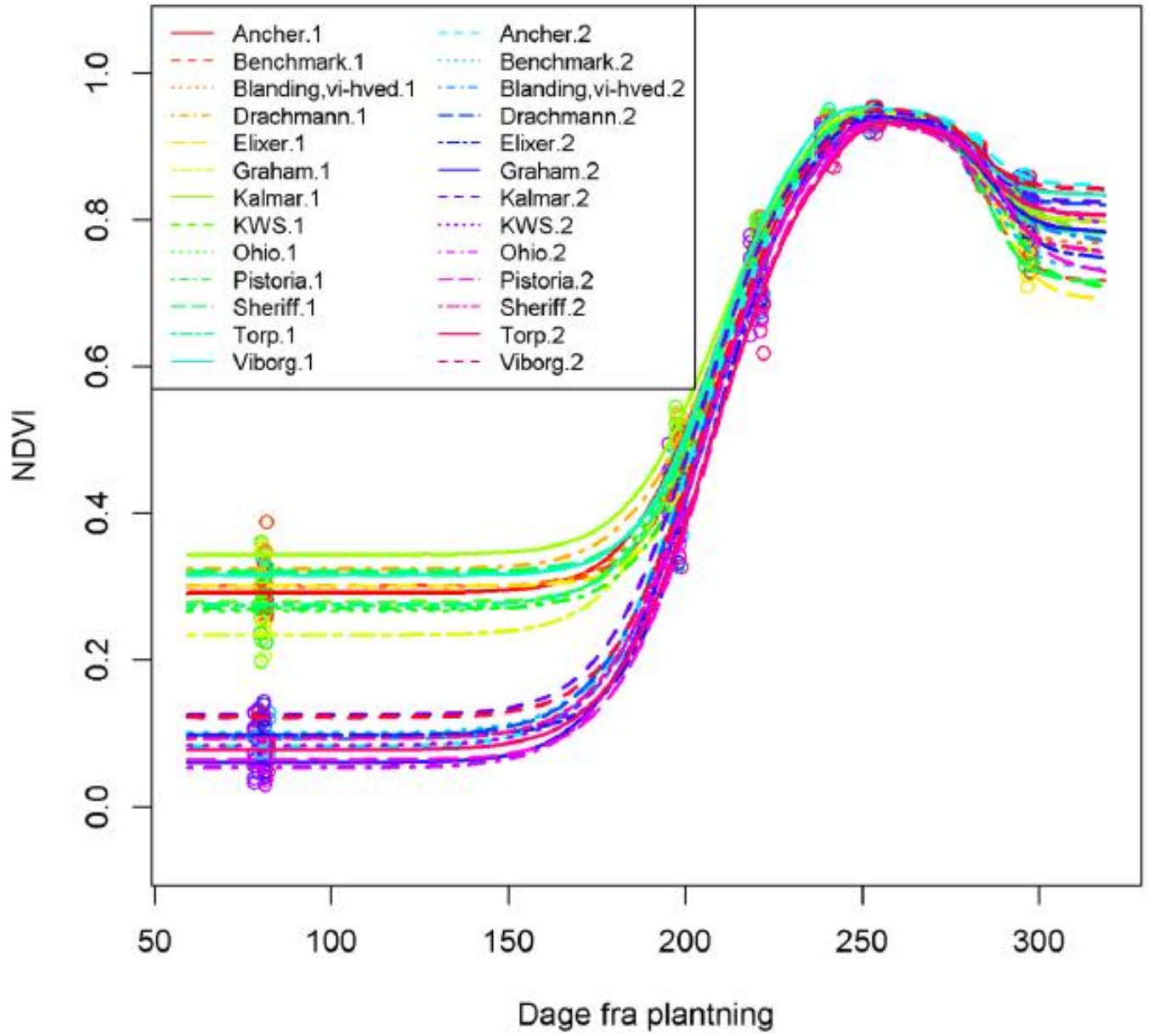

Varieties after early 5/9 and late 29/9 sowing
NDVI
1,0
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0,0
25. nov
04. jan
13. feb
25. mar
04. maj
13. jun
Benchmark, early
Benchmark, late
Kalmar, early
Kalmar, late
Torp, early
Torp, late


Varieties after early 5/9 and late 29/9 sowing
NDVI
0,95
0,85
0,75
0,65
0,55
0,45
0,35
19. mar
08. apr
28. apr
18. maj
07. jun
27. jun
Benchmark, early
Benchmark, late
Kalmar, early
Kalmar, late
Torp, early
Torp, late



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LANDBRUG FØDEVARER

Parameter estimates from growth curves

Sowing date	Variety	Autumn growth	Max slope	Days to max slope
5. Sept.	Kalmar	0,34 a	-15,5 ab	211 abcd
	Torp	0,27 cde	-15,9 ab	211 abcd
	Benchmark	0,30 abcd	-18,8 b	212 abc
29. Sept.	Kalmar	0,12 f	-14,2 ab	206 d
	Benchmark	0,10 fg	-13,6 ab	208 bcd
	Torp	0,08 gh	-13,7 ab	210 abcd

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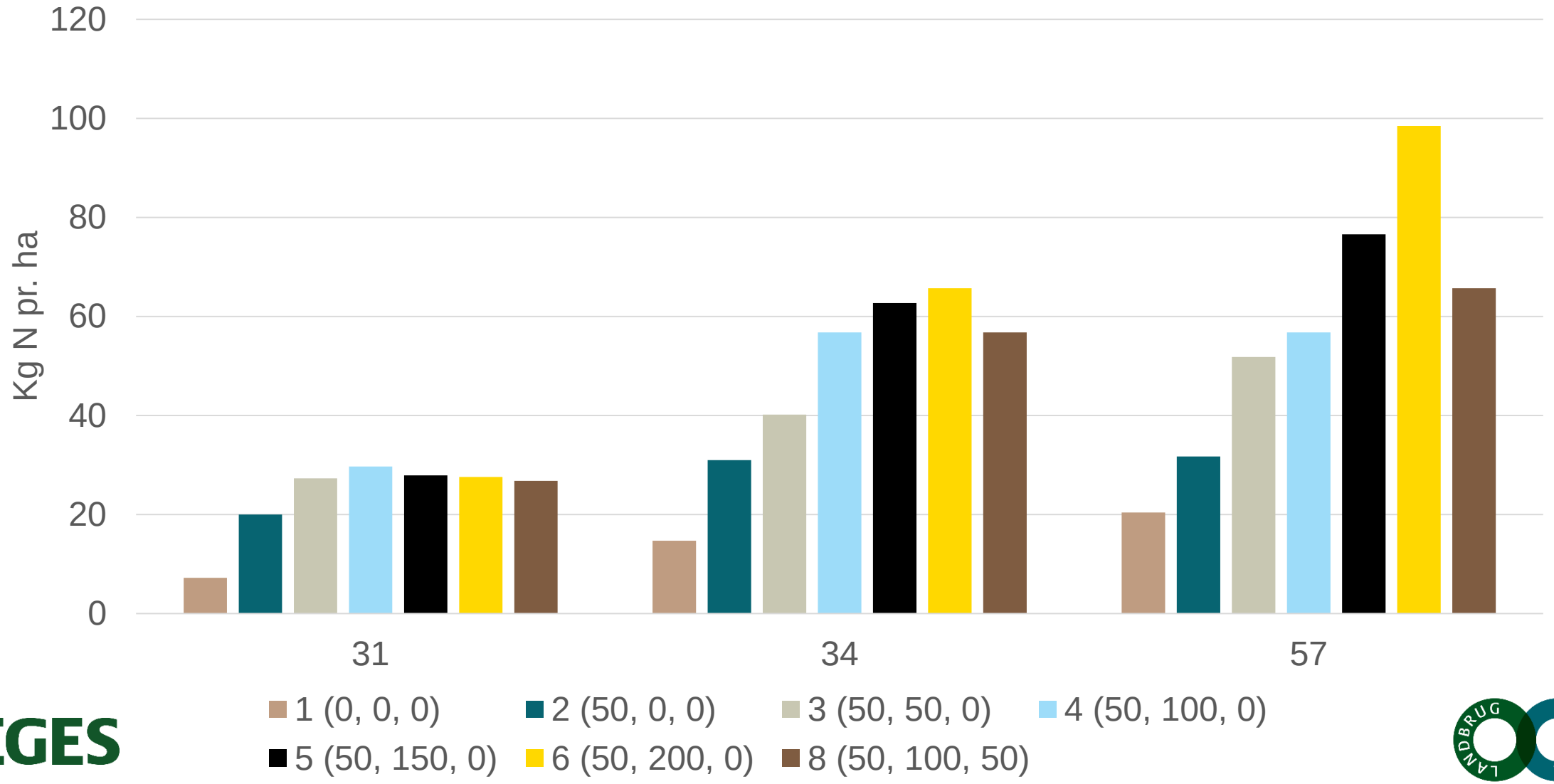
Fertilizer trials in wheat: Nitrogen uptake



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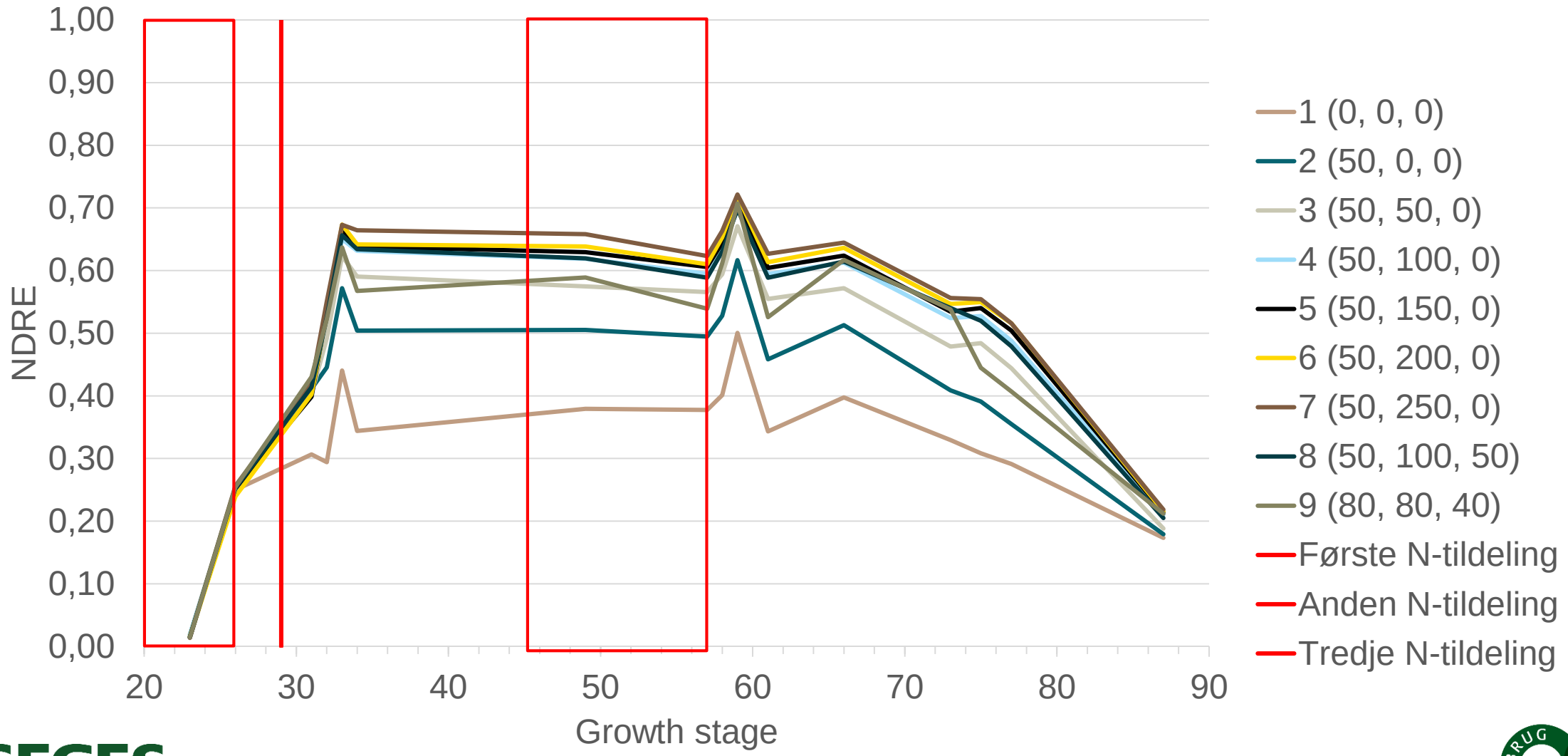
Fertilizer trials in wheat: NDRE index, 3 trials



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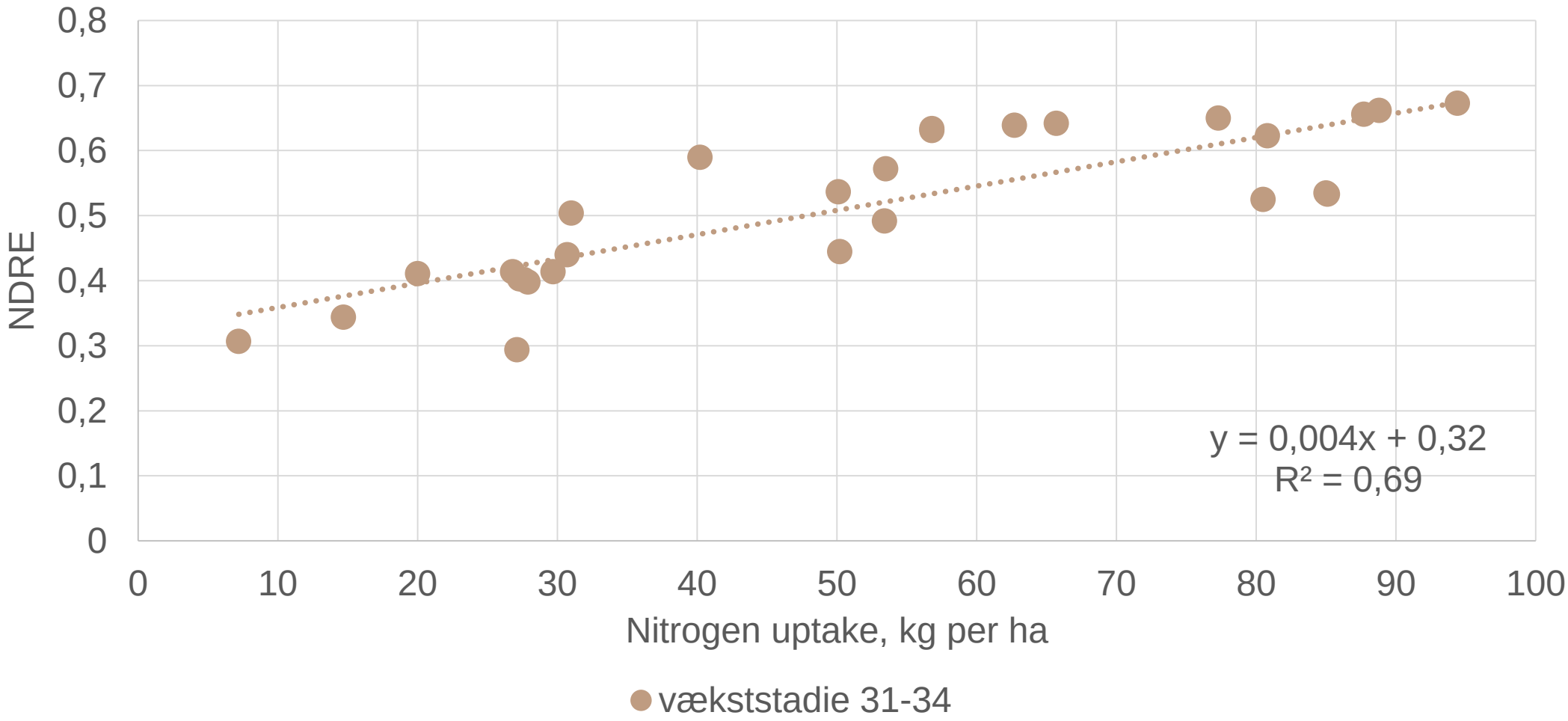
Fertilizer trials in wheat: Measured nitrogen uptake and NDRE



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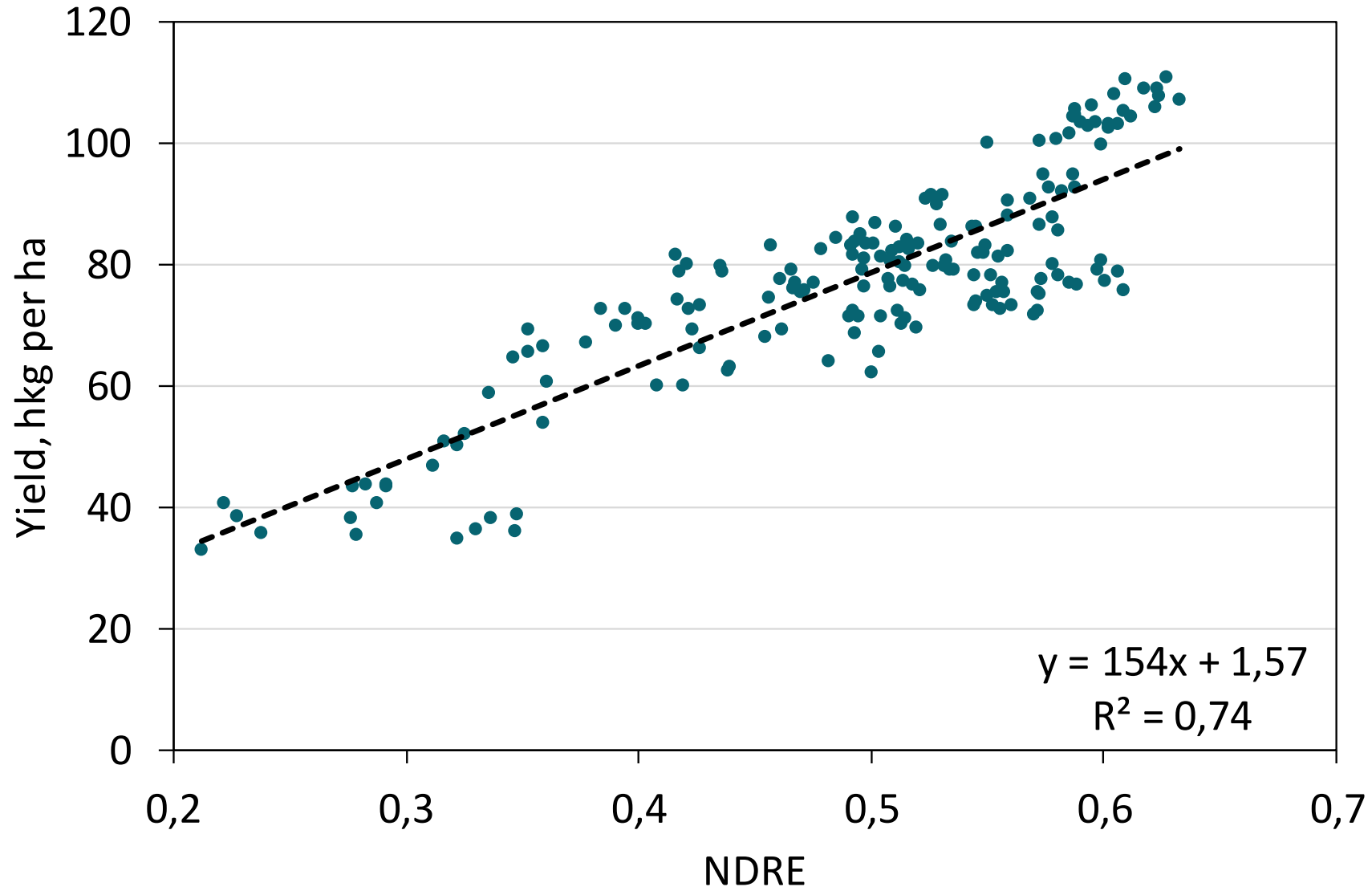
Fertilizer trials in wheat: NDRE GS 75 and grain yield



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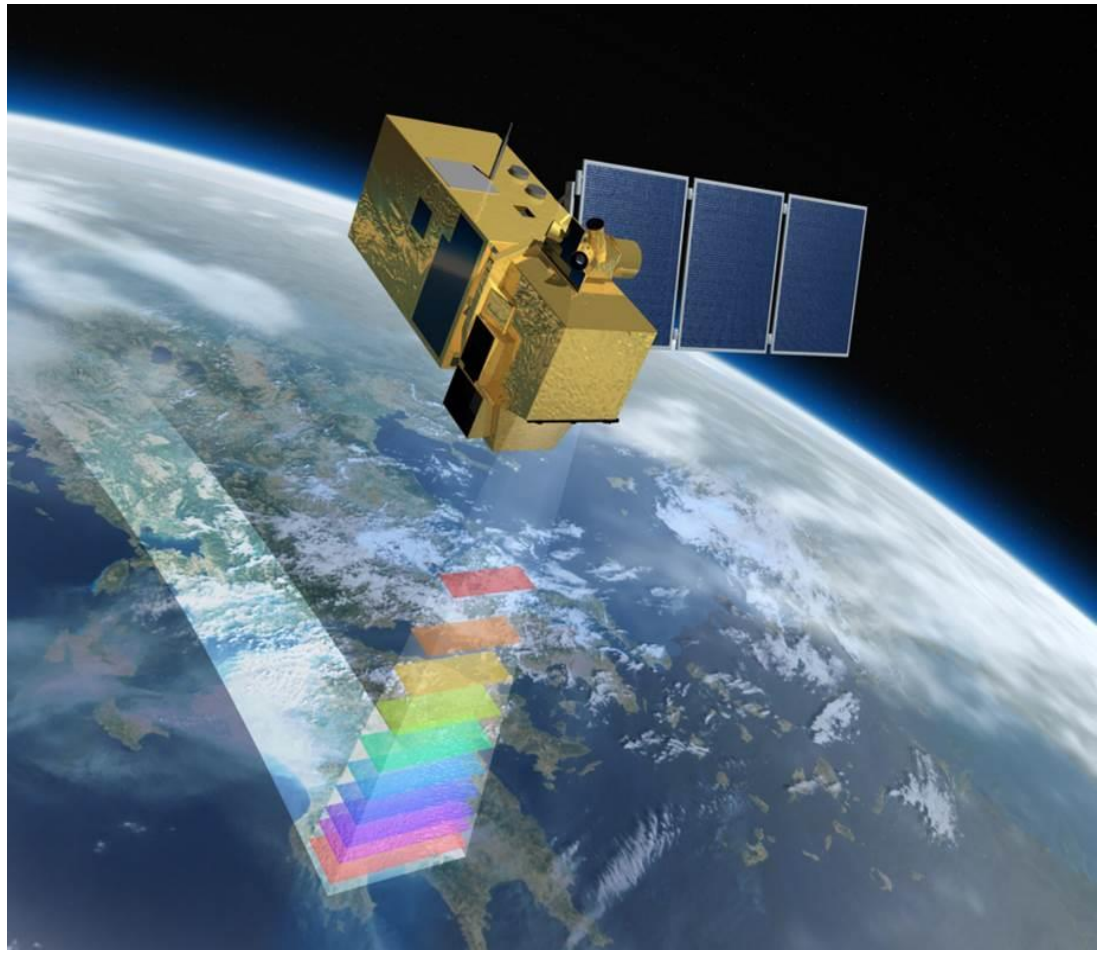
Sentinel 2 satellites



- Multispectral camera with 13 wavelengths 500 – 2.200 nm
- Resolution NDVI: 10 m, and NDRE: 20 m
- Denmark covered every 5 days

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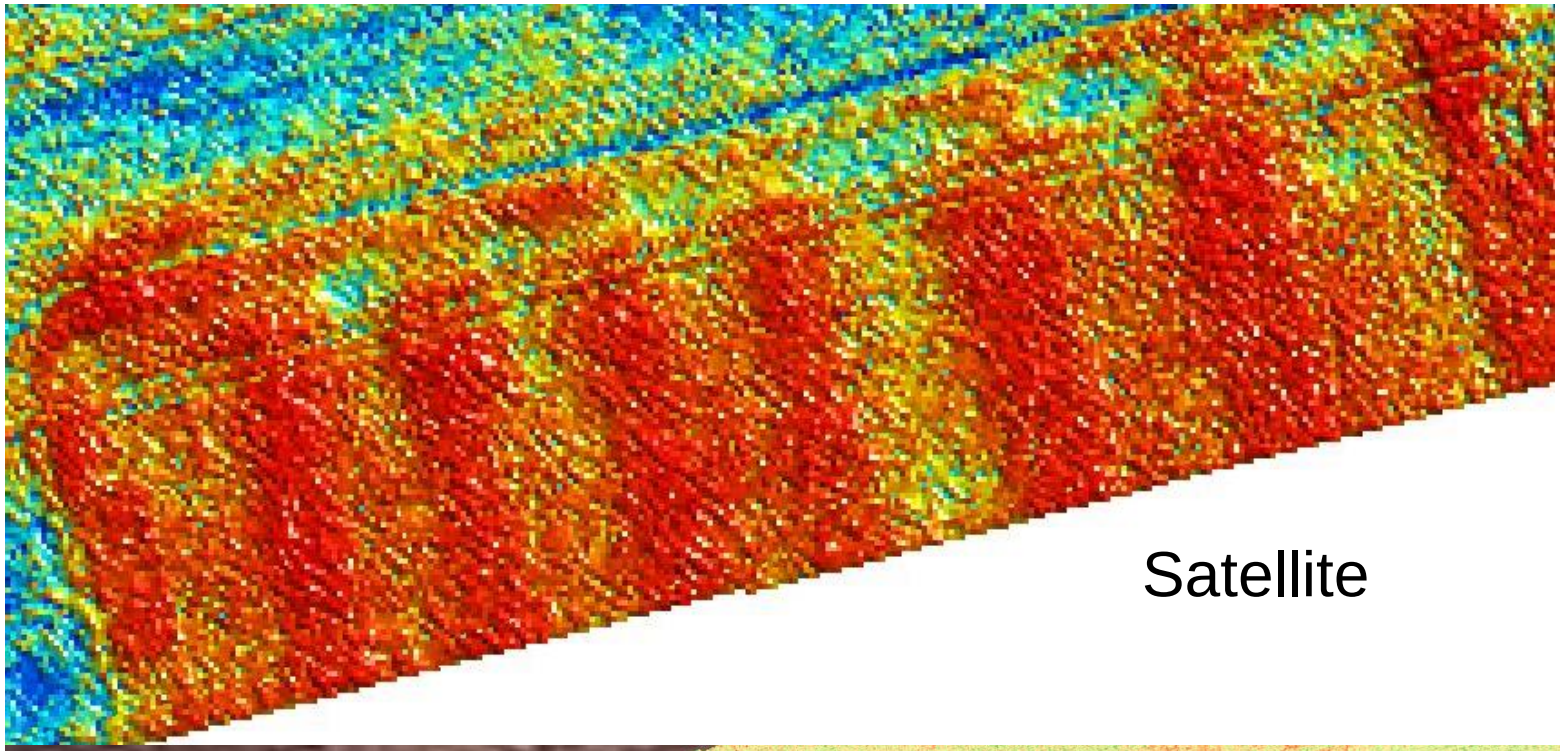
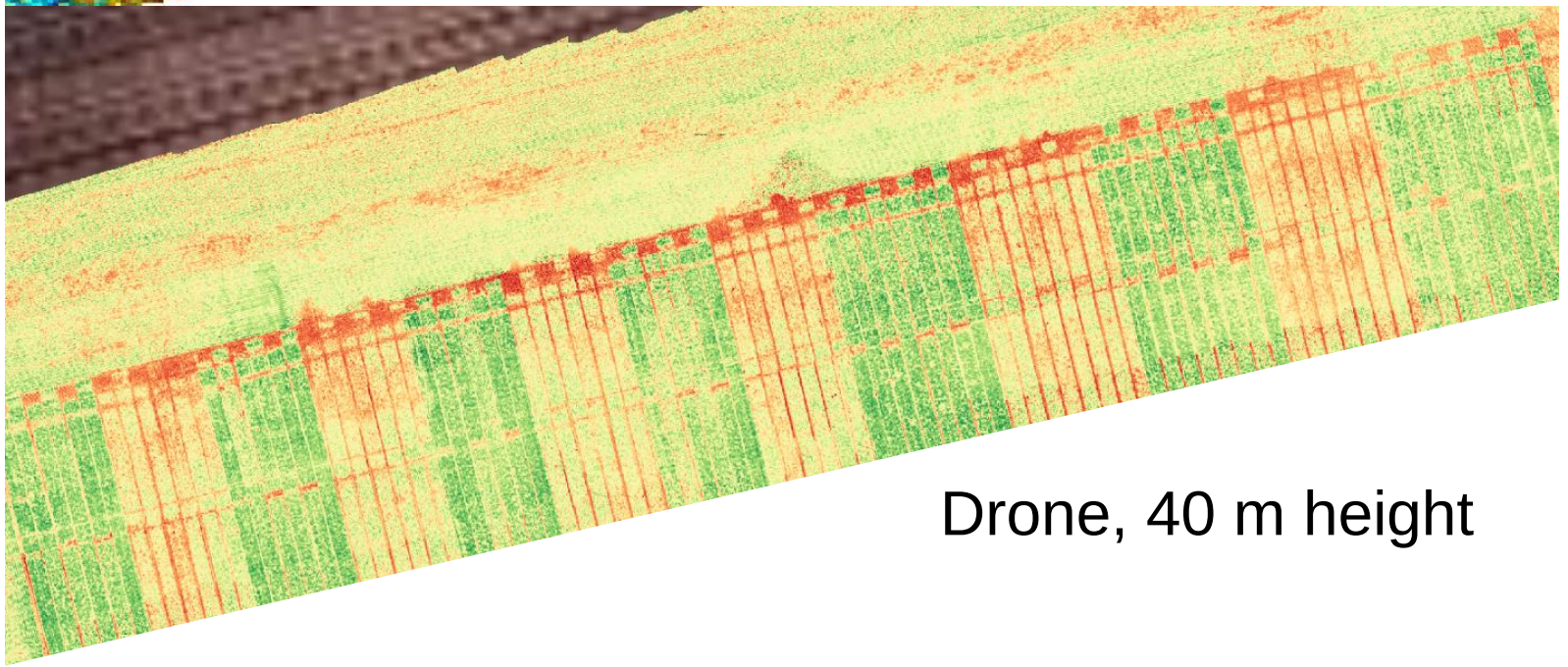
Commercial satellites with 40 cm resolution



Satellite



Drone, 40 m height

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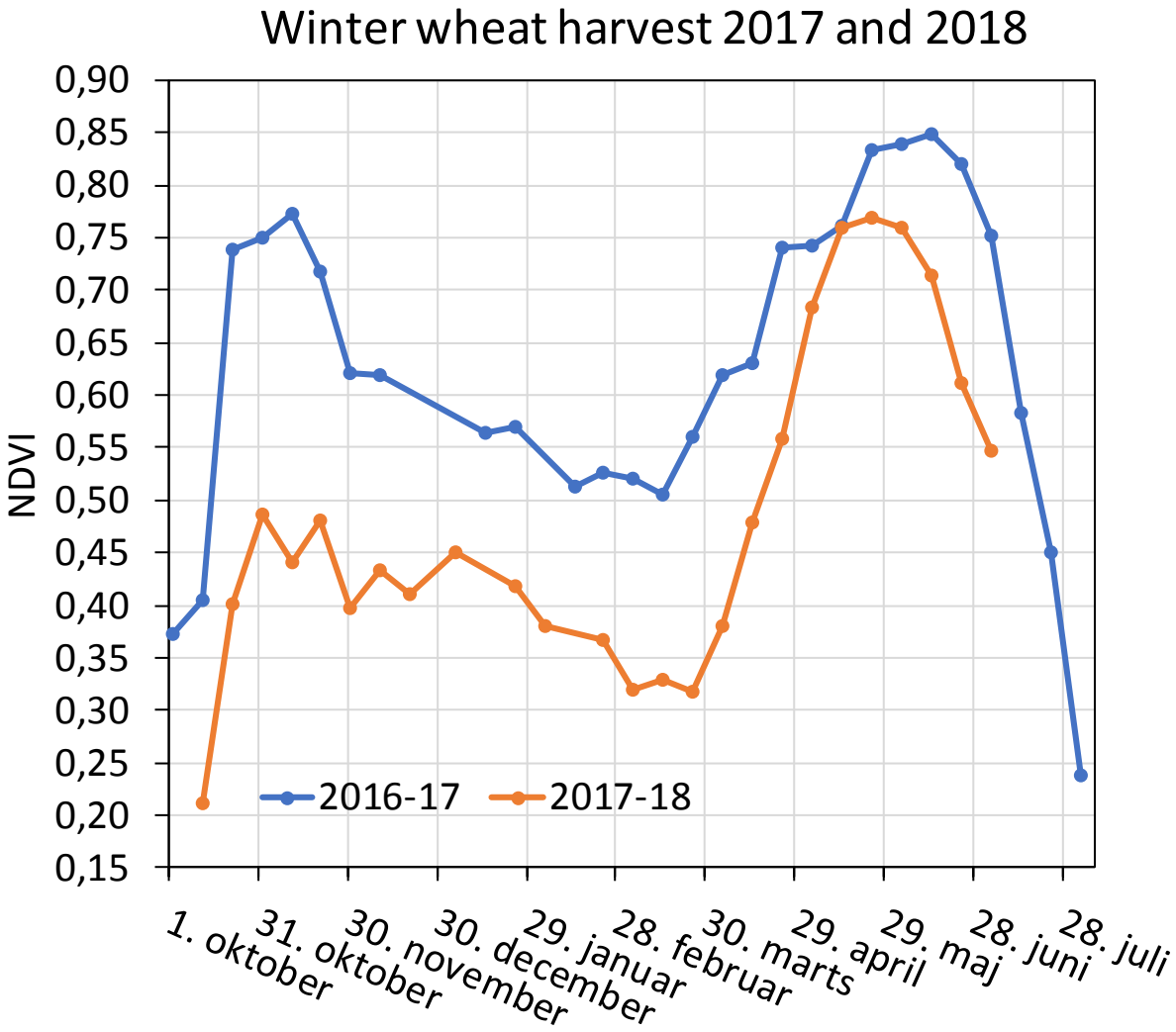
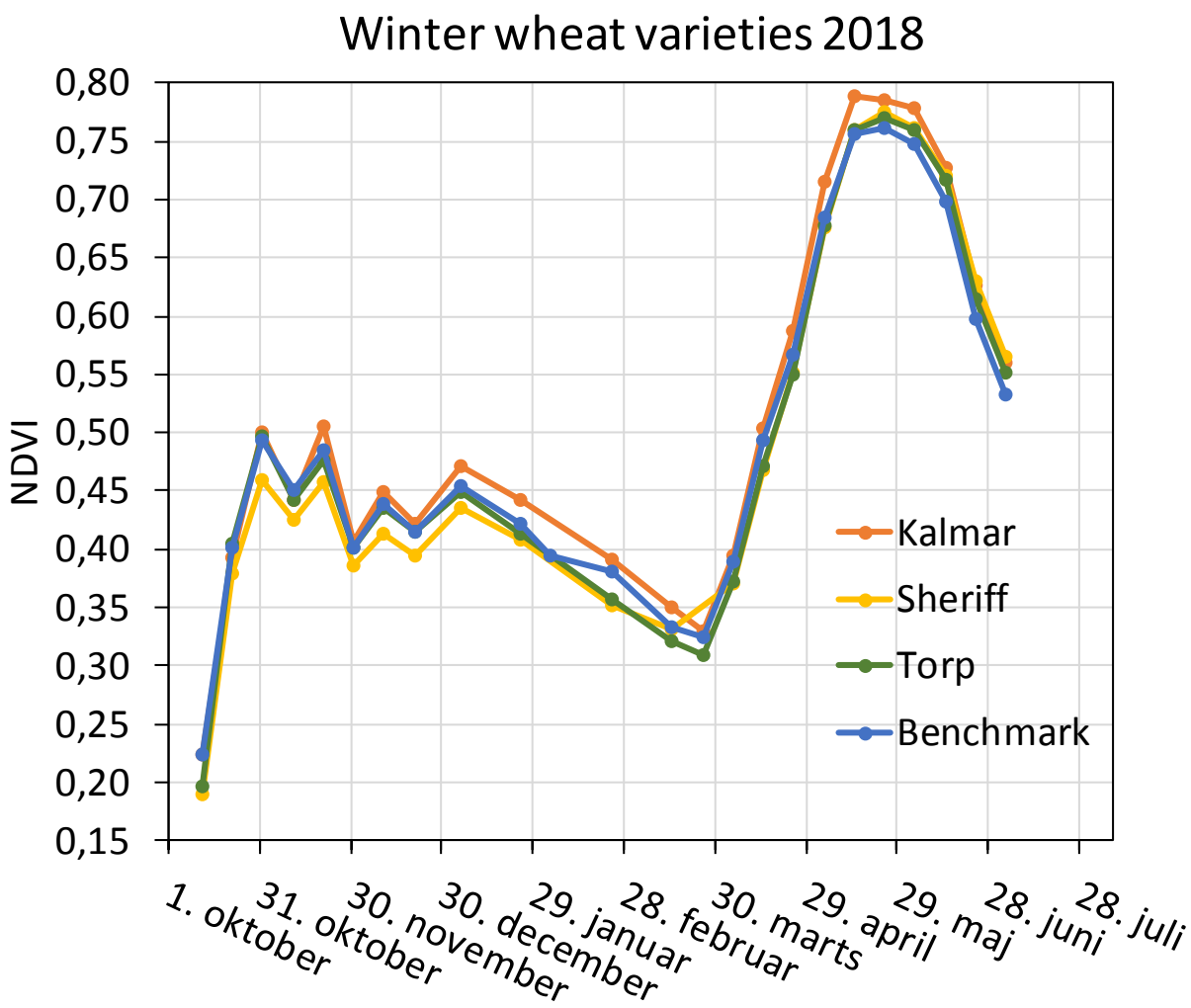
Measurements of Danish wheat fields from satellite





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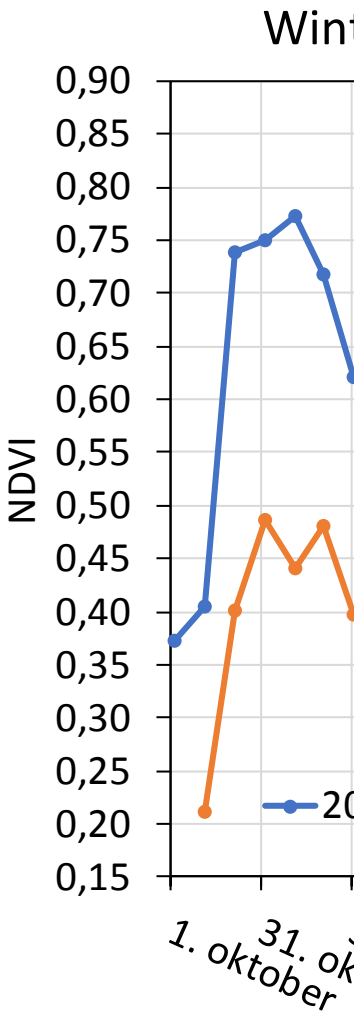
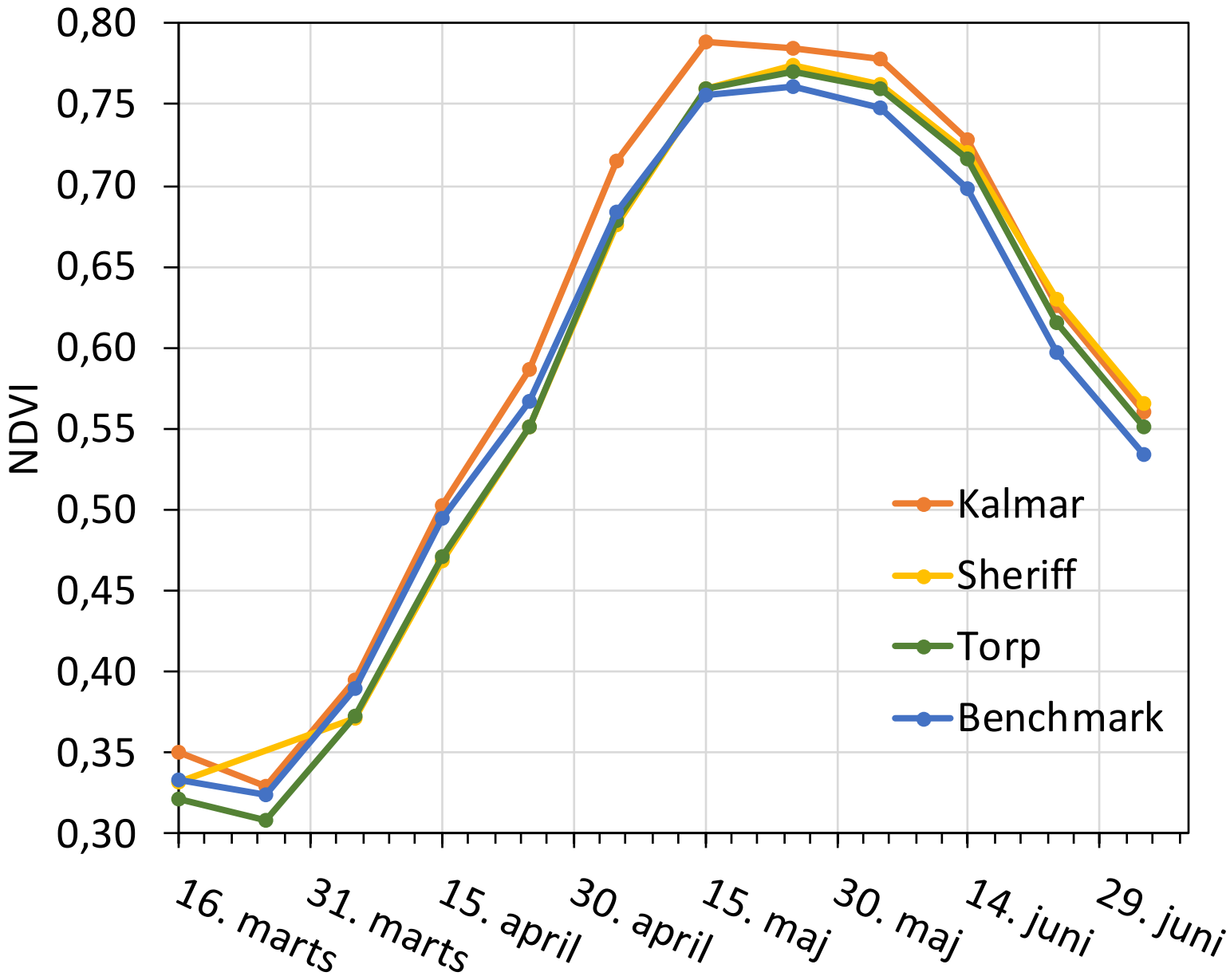
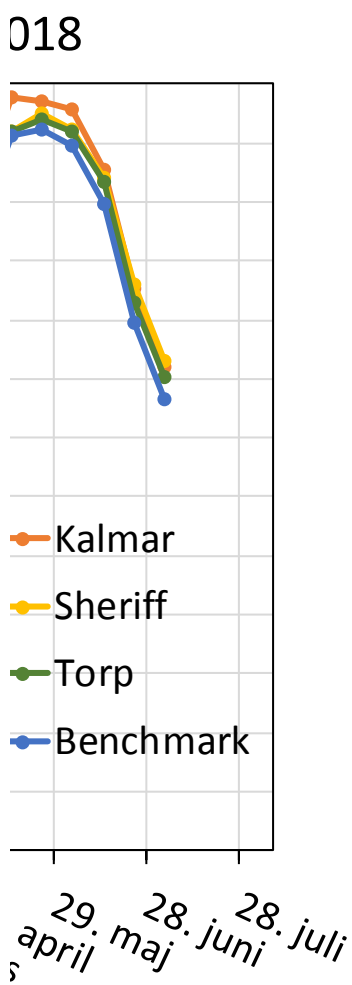
Measurem







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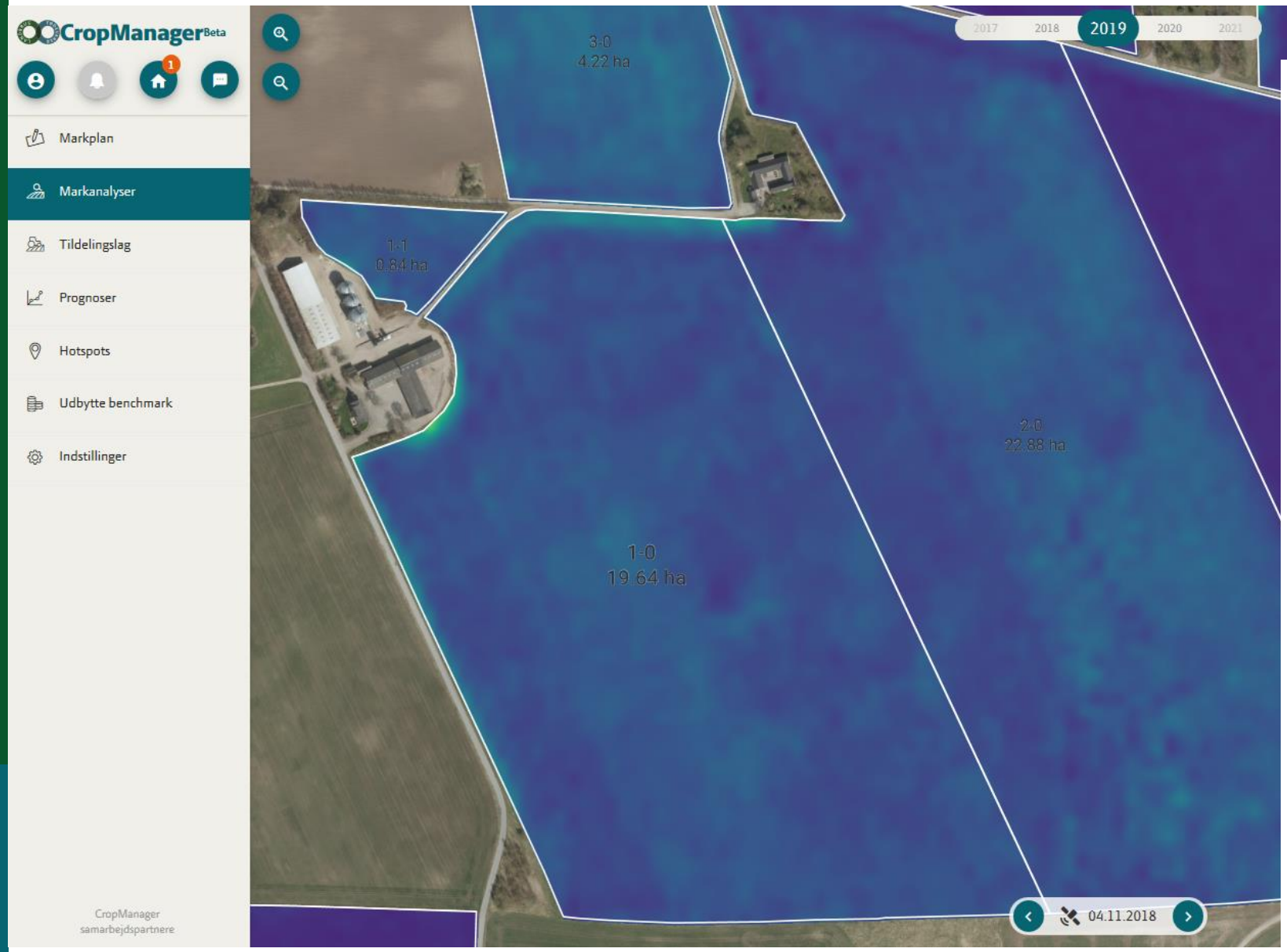
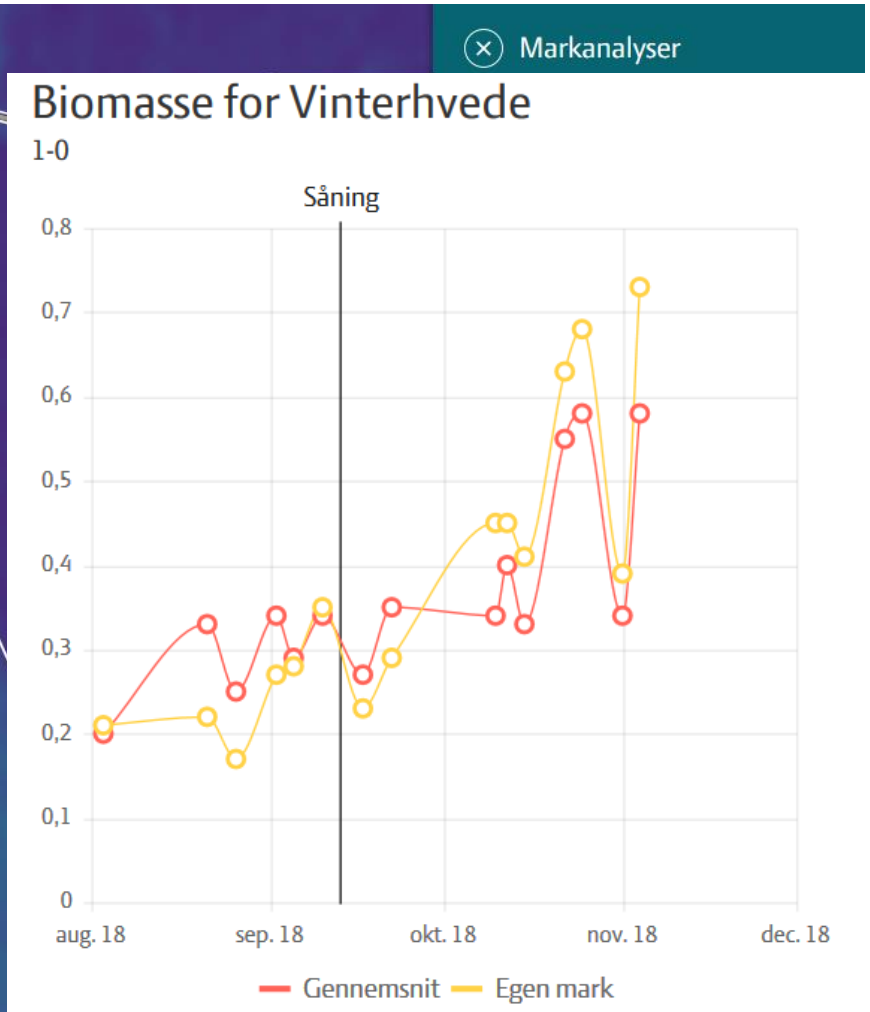
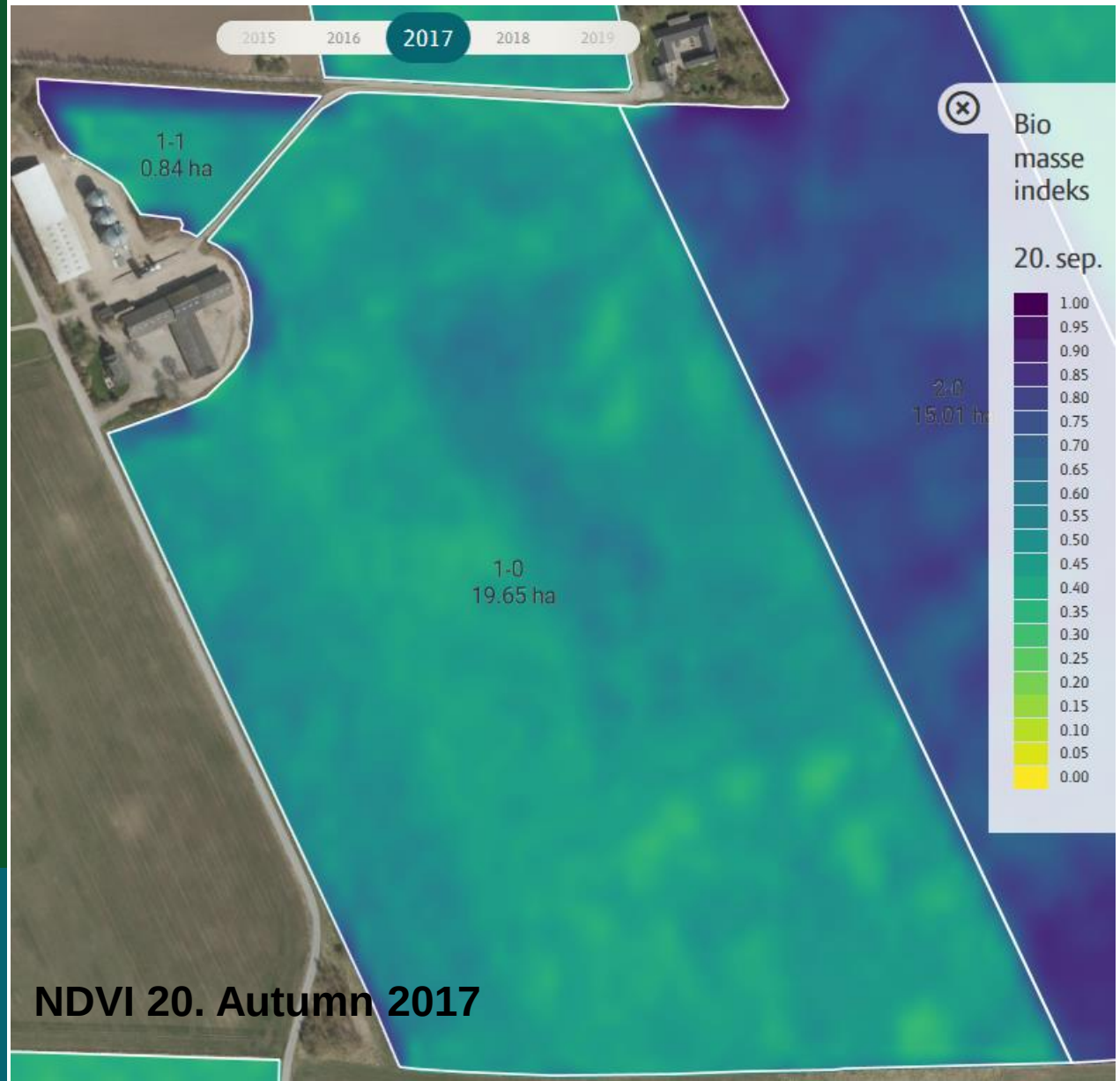
NDVI on CropManager.dk



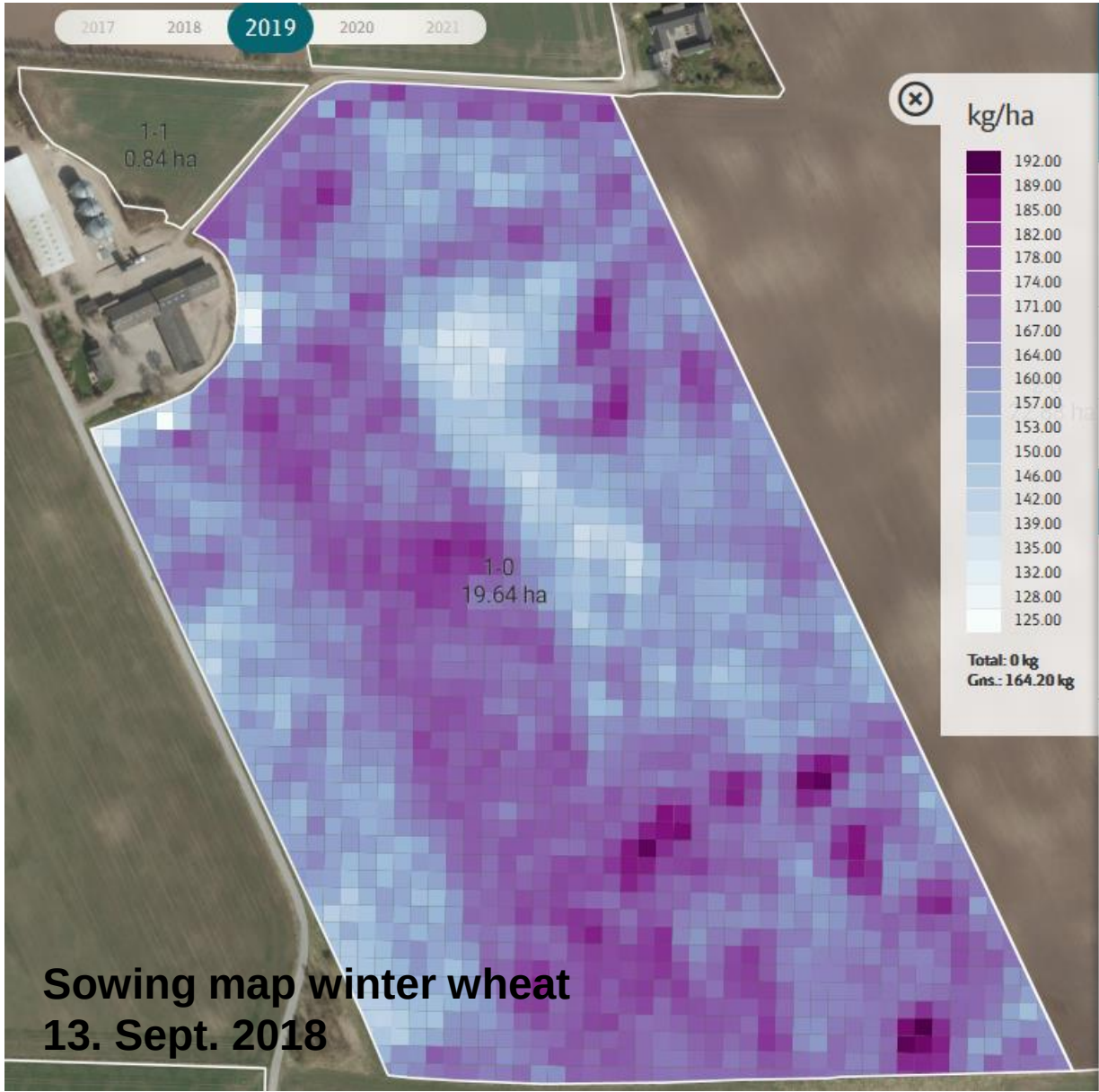


Den gule kurve viser biomassen i din mark og den røde kurve biomassen for 409 marker med samme afgrøde beliggende indenfor 10 km radius.

Precision farming, variable seed rates



NDVI 20. Autumn 2017



Sowing map winter wheat
13. Sept. 2018

Summary on the use of drone and satellite images

- Drone images:
  - Document the quality of field trials
  - Cultivar evaluation, growth habits
  - Estimate of nitrogen uptake
- Satellite images:
  - Crop analysis on field and country scale
  - Precision agriculture, variable application of:
    - Nitrogen, Growth regulators, Fungicides, Seed

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