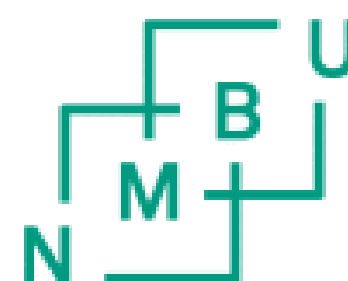


# Breeding toolbox for sustainable food system of the Nordic-Baltic region (2021-2023)



Norwegian University  
of Life Sciences



Gintaras Brazauskas  
Project leader

30.11.2022



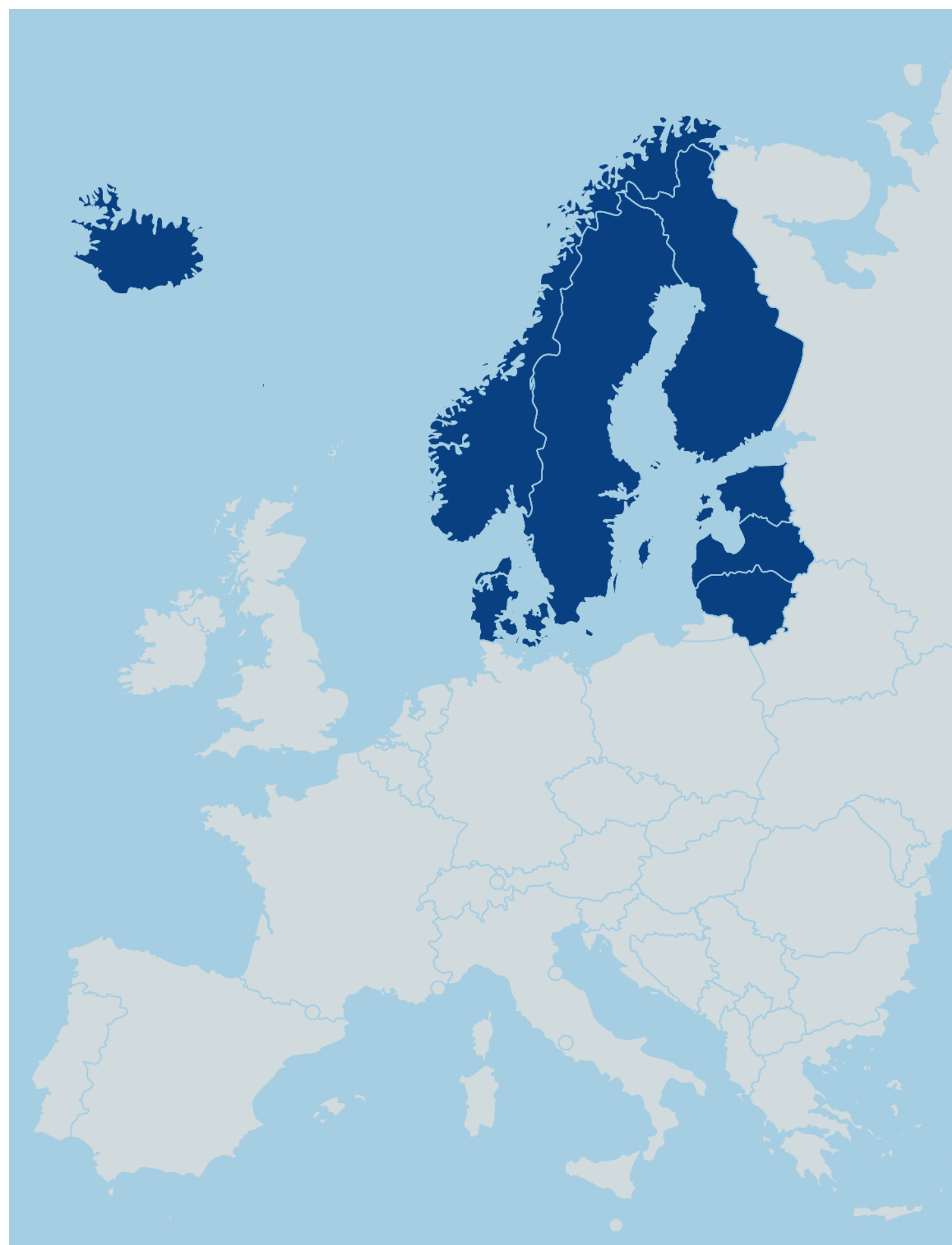
# Lithuanian Research Centre for Agriculture and Forestry (LAMMC) in brief



- est. 1922
- 3 institutes
- 505 employees
- 168 researchers
- 69 PhD students
- 40 international grants
- 60 national grants
- 180 industry contracts
- [www.lammc.lt](http://www.lammc.lt)

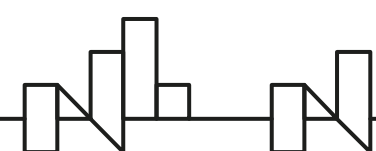


# Wheat production in the Nordic-Baltic region in 2021



Country	Cult. area, kha	Harvest, kt	Yield, t/ha
Lithuania	944	4285	4.54
Denmark	538	4047	7.52
Latvia	537	3028	5.64
Sweden	479	2408	5.03
Finland	212	736	3.47
Estonia	180	687	3.82
Norway	64	267	4.17
Total/average	2,957	15,494	5.24

- 12 % of EU common wheat area (2021);
- 11 % of EU common wheat production (2021);
- Exports: LT 3,513 kt; LV 2,508 kt; EE 608 kt in 2019.



# Work packages of the NOBALwheat project

WP1

- Identification of high plasticity wheat genotypes by phenotyping

WP2

- Implementing low-cost high throughput plant phenotyping in Baltic wheat breeding

WP3

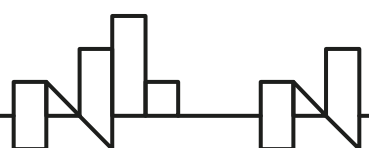
- Identification of QTL markers for traits of interest and implementation of Genomic Selection into breeding programs

WP4

- Measuring plant-gas-exchange of selected varieties under field and laboratory conditions

WP5

- Provision of multilateral knowledge and technology transfer between the partnering countries

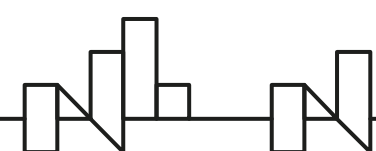
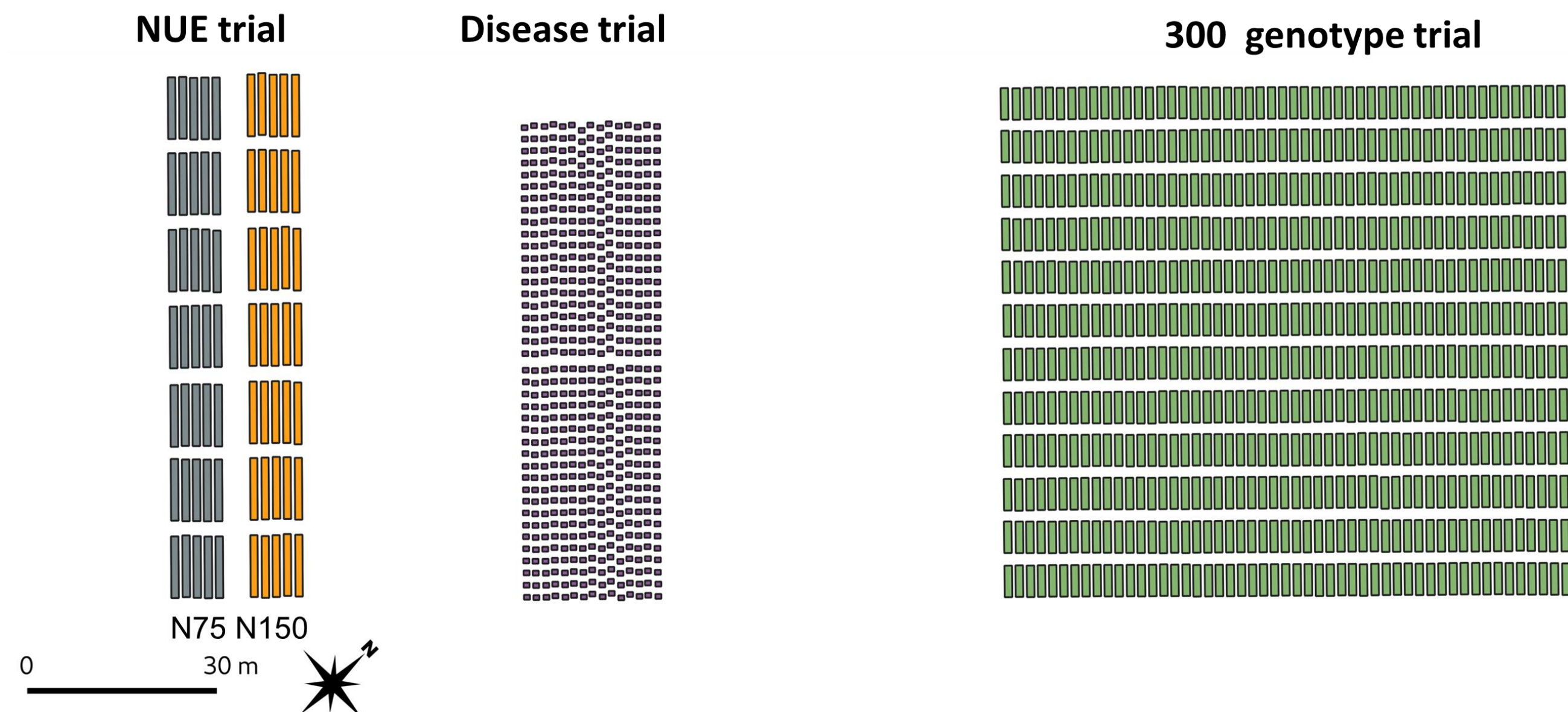




# WP1: Identification of high plasticity wheat genotypes by phenotyping

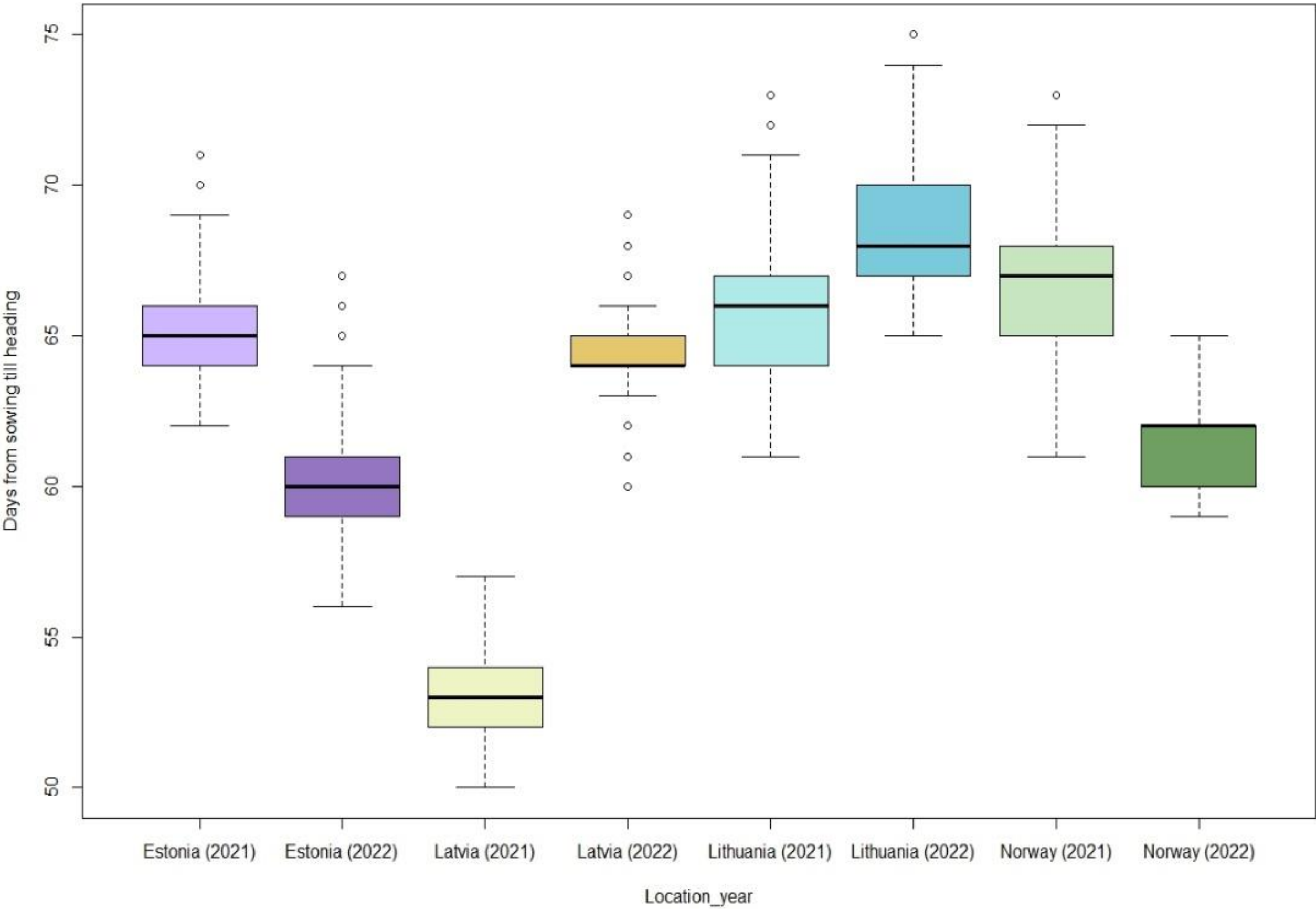


- Core germplasm collection of 300 genotypes
- Field evaluation at 4 locations over 3 seasons
- Yield and other agronomic traits

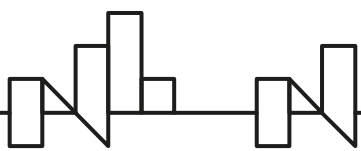
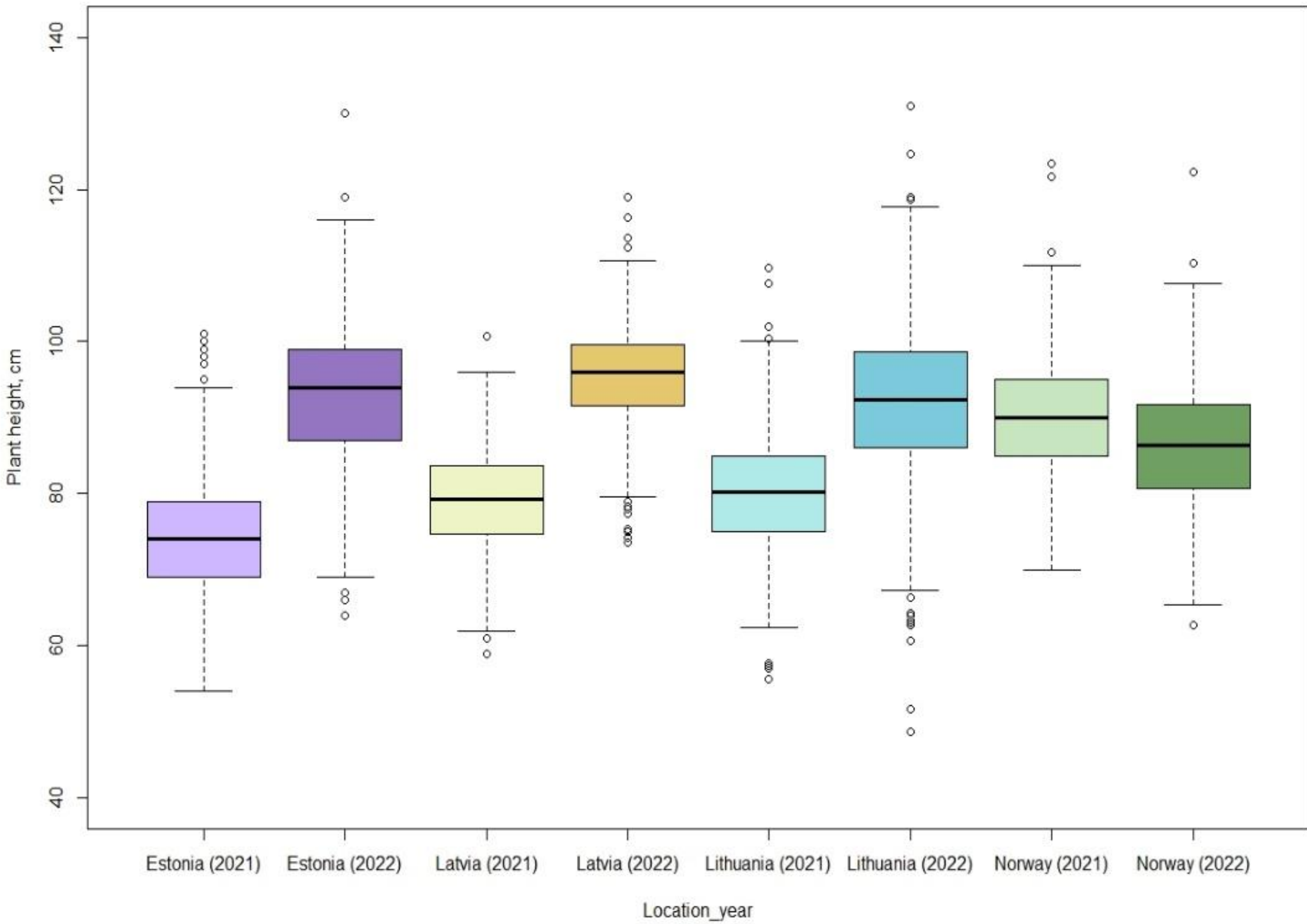


# Trait variance across locations and years (1)

Days to heading



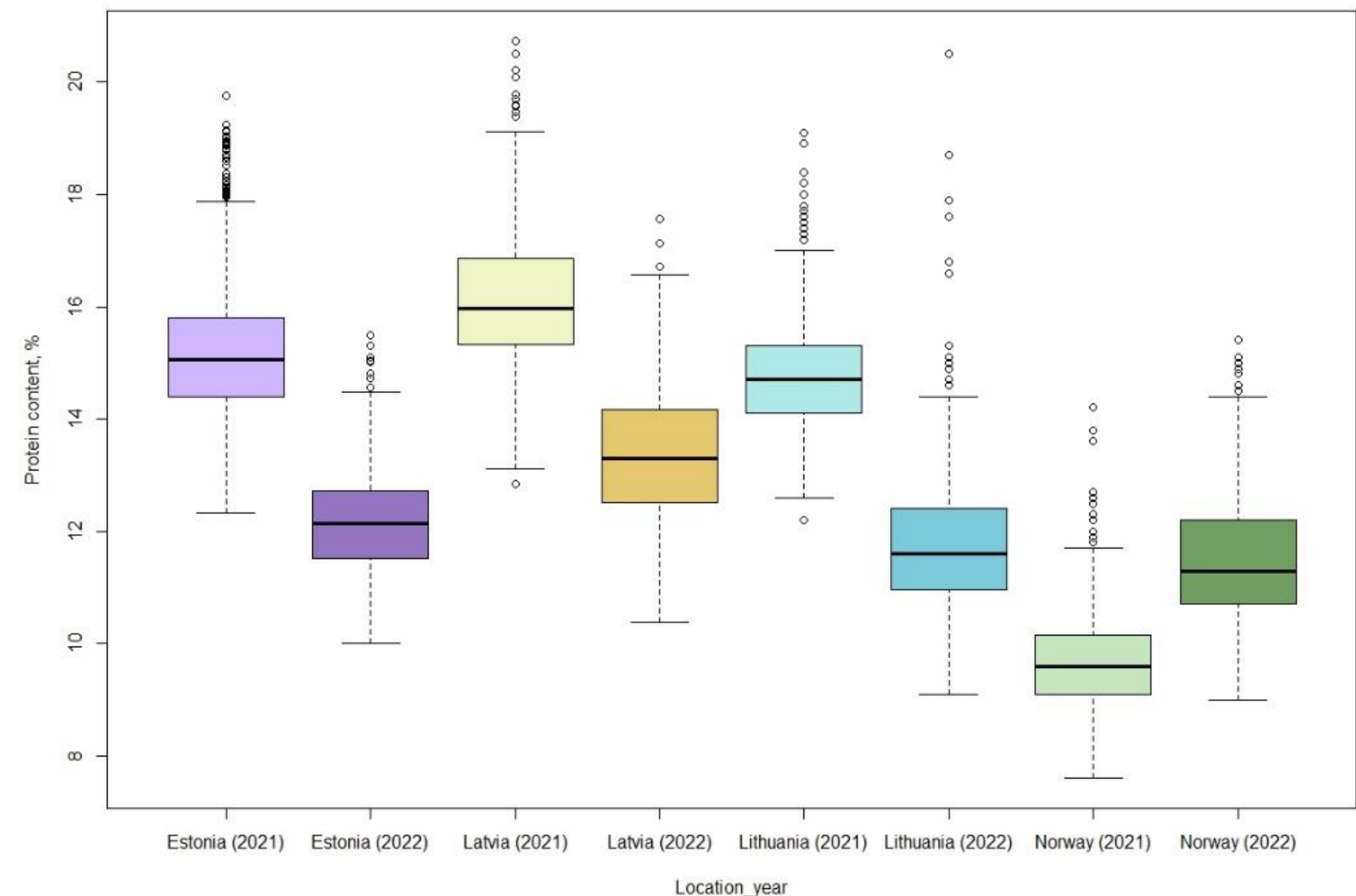
Plant height



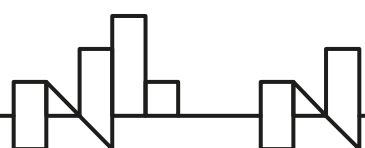
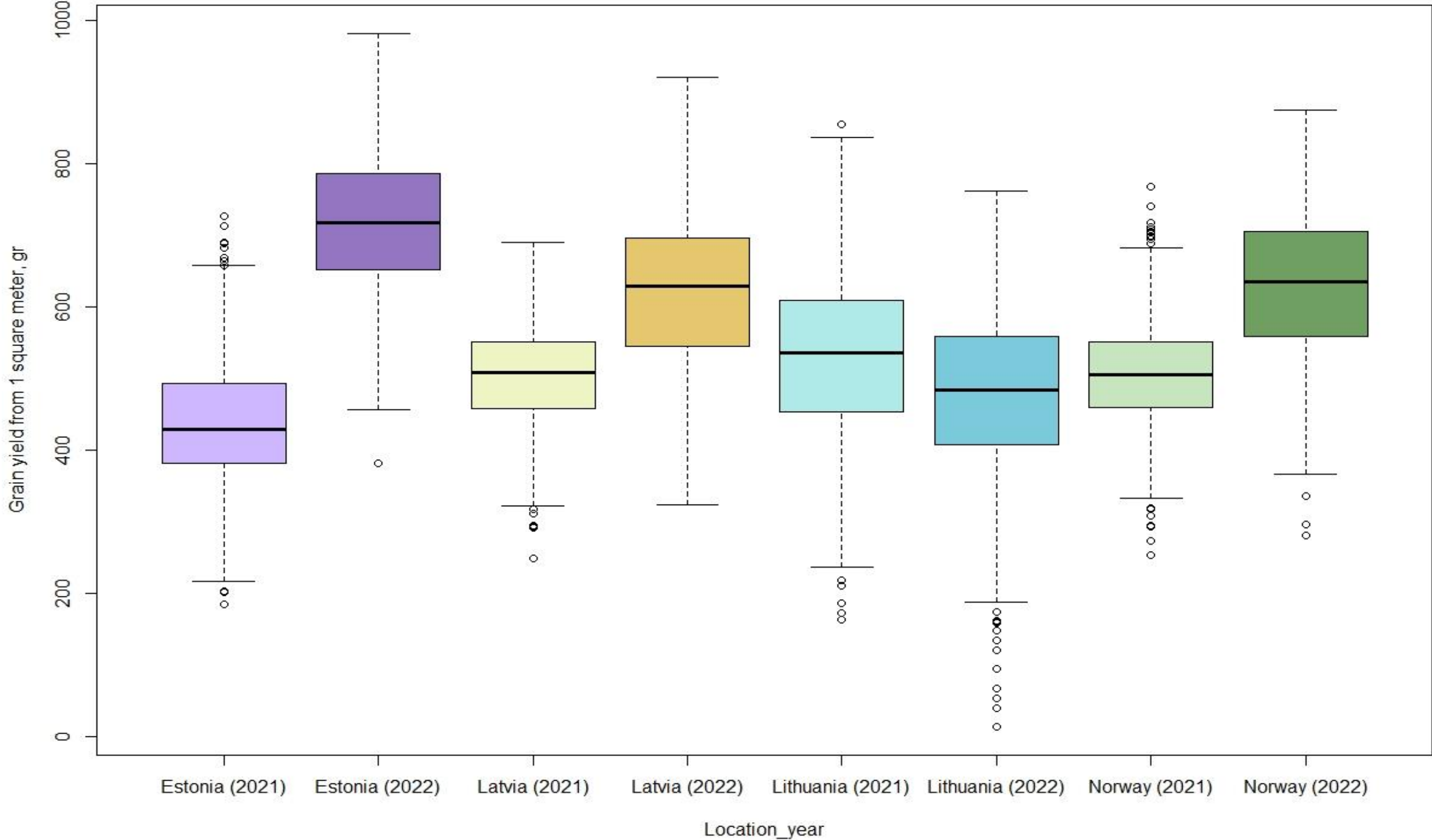


# Trait variance across locations and years (2)

Grain protein content

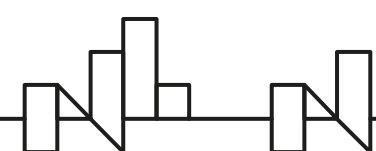


Grain yield



# Diseases, occurrence and severity (mean %)

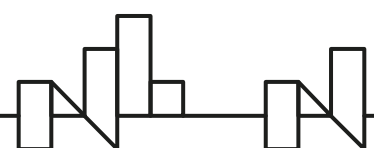
Disease	Estonia		Latvia		Lithuania		Norway	
	2021	2022	2021	2022	2021	2022	2021	2022
Powdery mildew	1.9	4.3	30.6	32.2	7.9	5.3	13.7	17.7
<i>Septoria tritici</i>	0.3	5.3	27.3	36.5	11.2	39.4	-	-
<i>Septoria nodorum</i>	-	-	1.4	22.5	-	-	-	-
Tan spot	1.7	17.9	-	-	-	-	-	-
Leaf rust	0.1	1	12.2	-	22.5	-	-	8.5
Yellow rust	-	0.1	1.2	-	-	-	1.6	14.9
Stem rust	0.2	0.1		-	-	-	-	4.9





# WP2: Implementation of low-cost high- throughput plant phenotyping in Baltic wheat breeding

- High-Throughput Plant Phenotyping platforms:
  - proximal sensing vehicles (phenomobiles)
  - unmanned aerial vehicles (UAVs or drones)
- Data collection and analysis





# UAV phenotyping

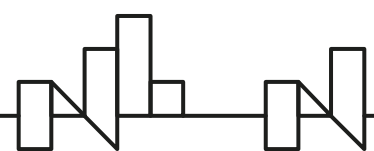
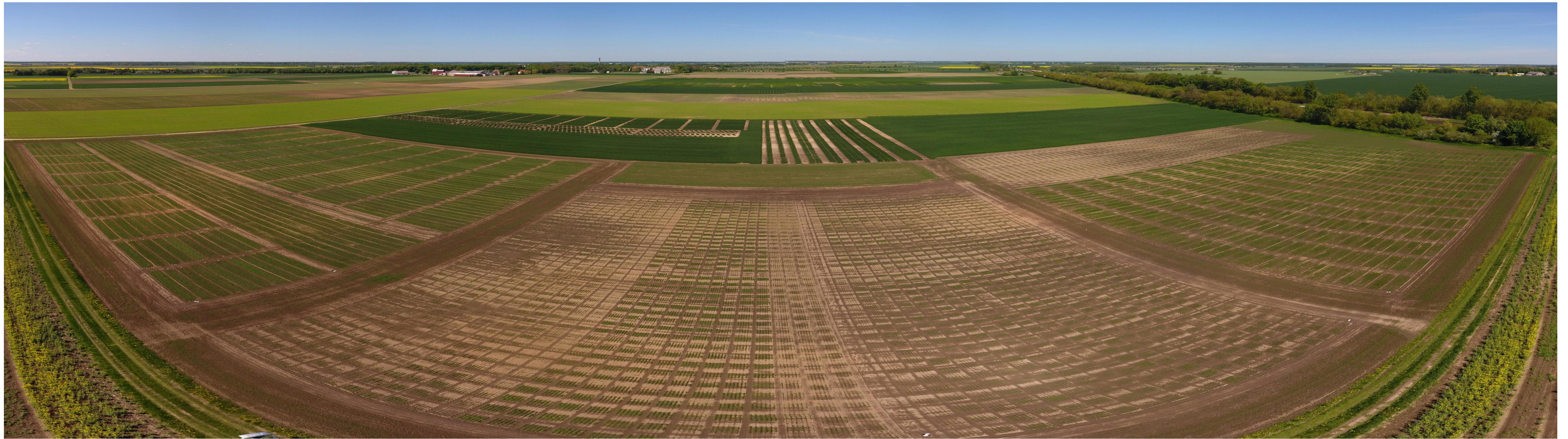


Weekly flights in LT, LV and EE and twice a week in NO.

Pix4D > QGIS > R

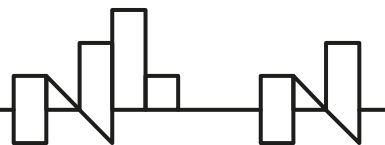
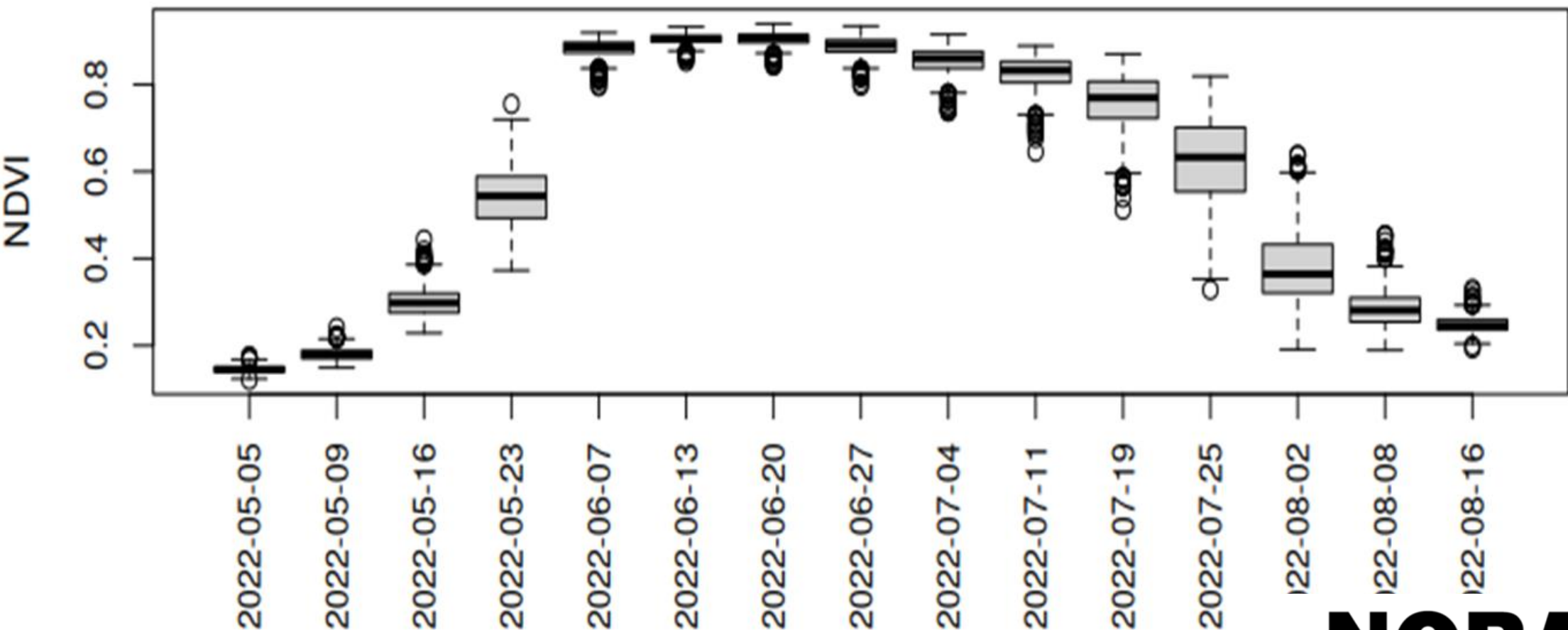
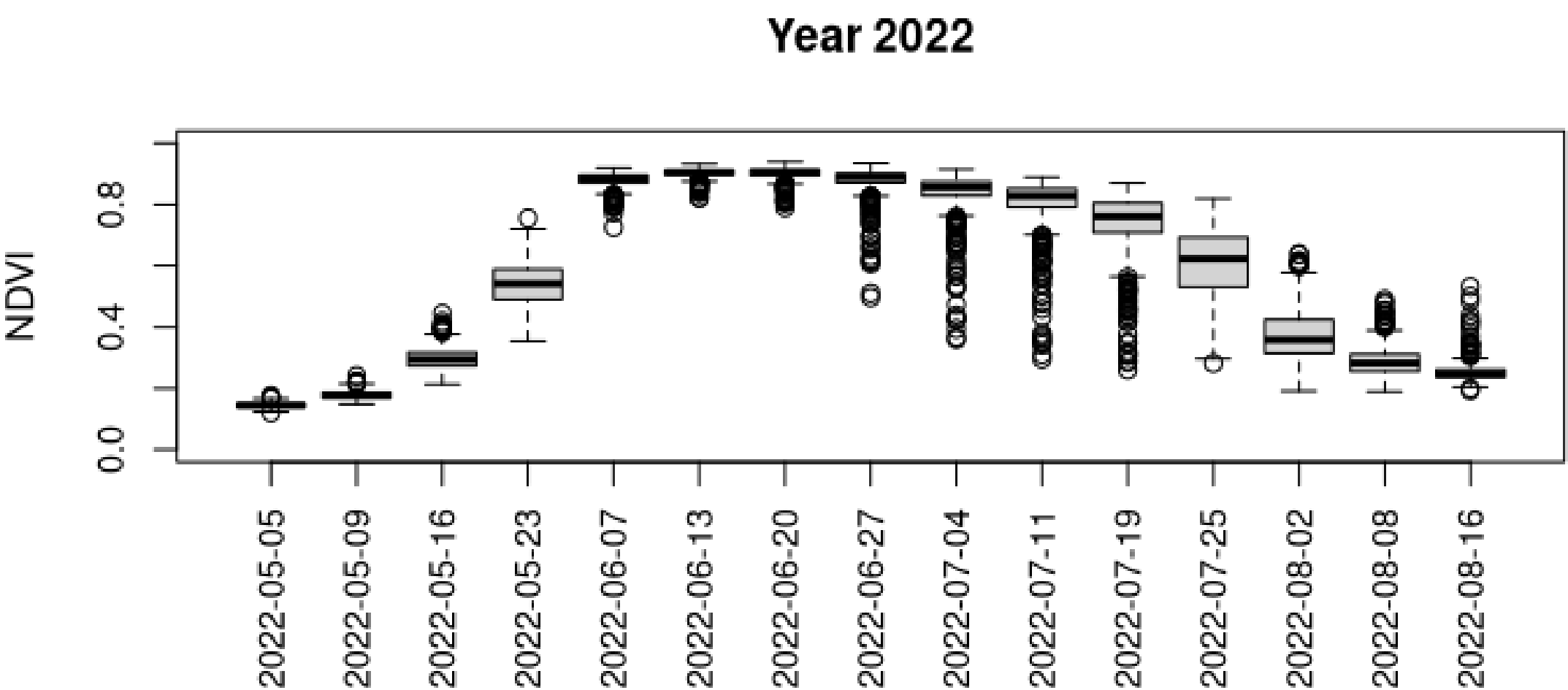
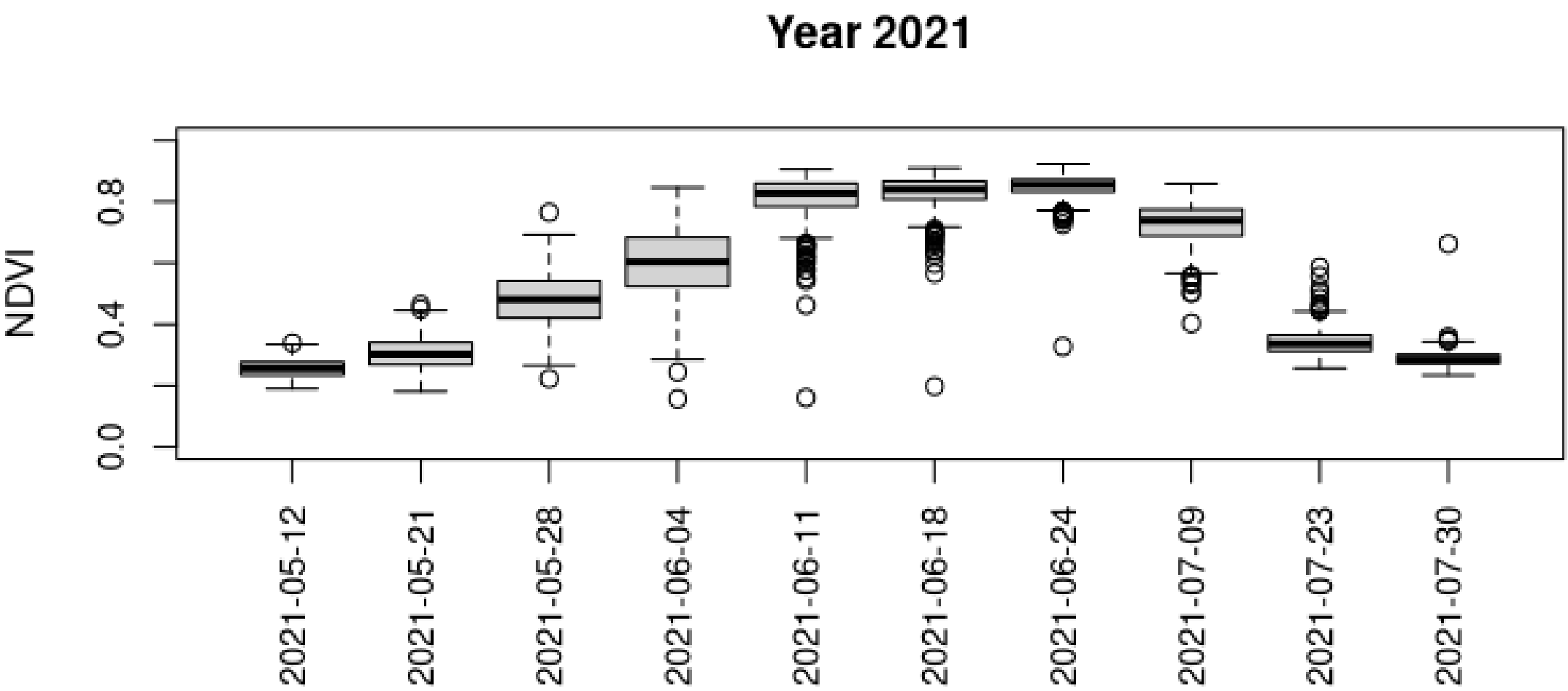
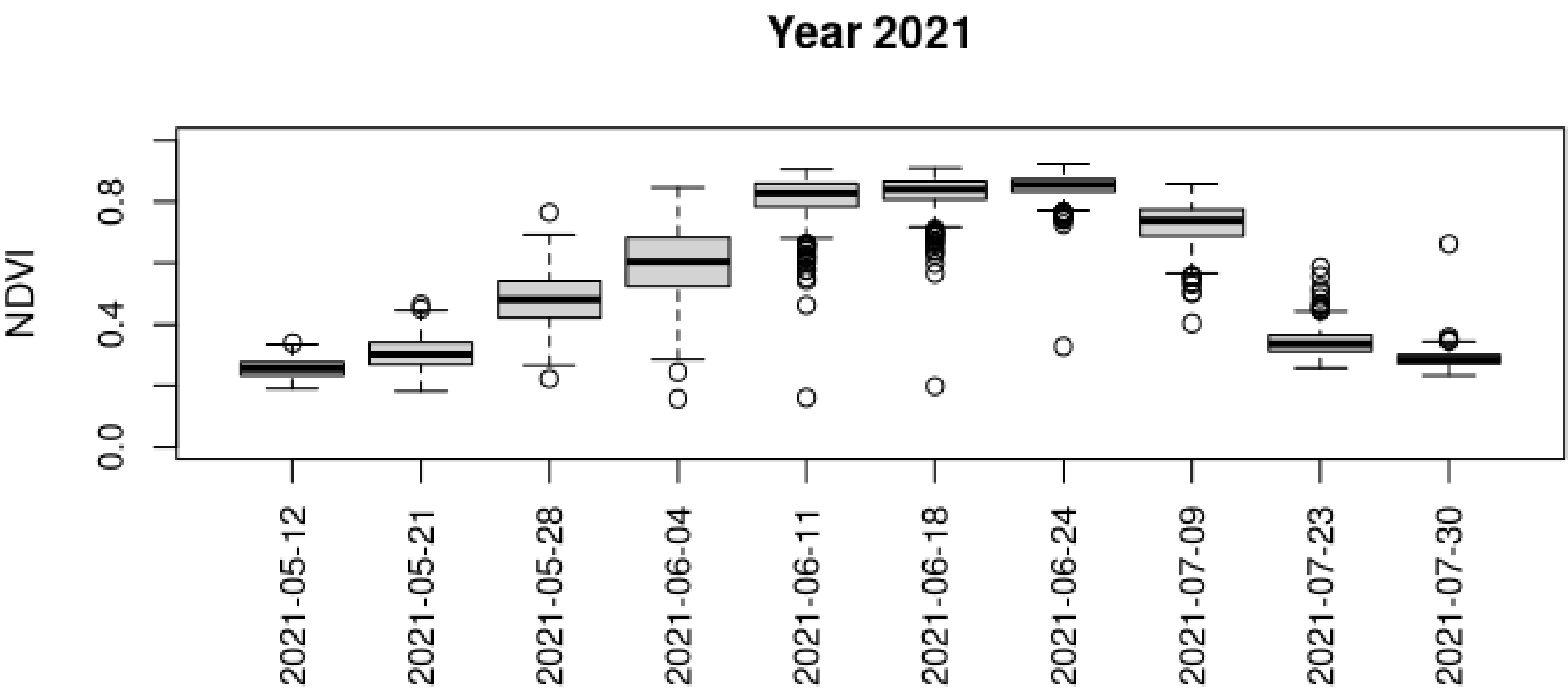
Multispectral images were used to estimate 27 vegetation indices.

From RGB images the mean canopy height of each plot was determined.

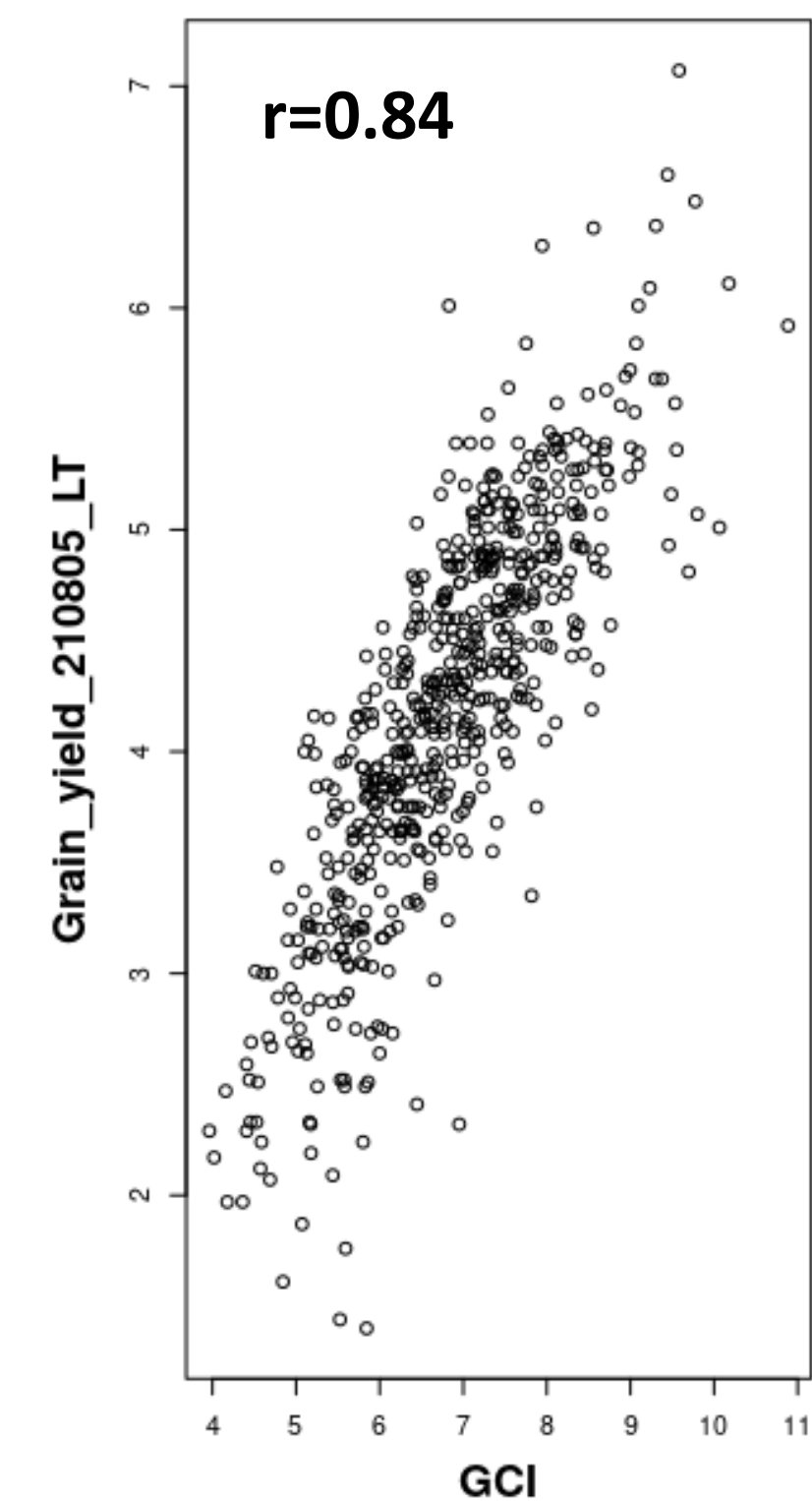
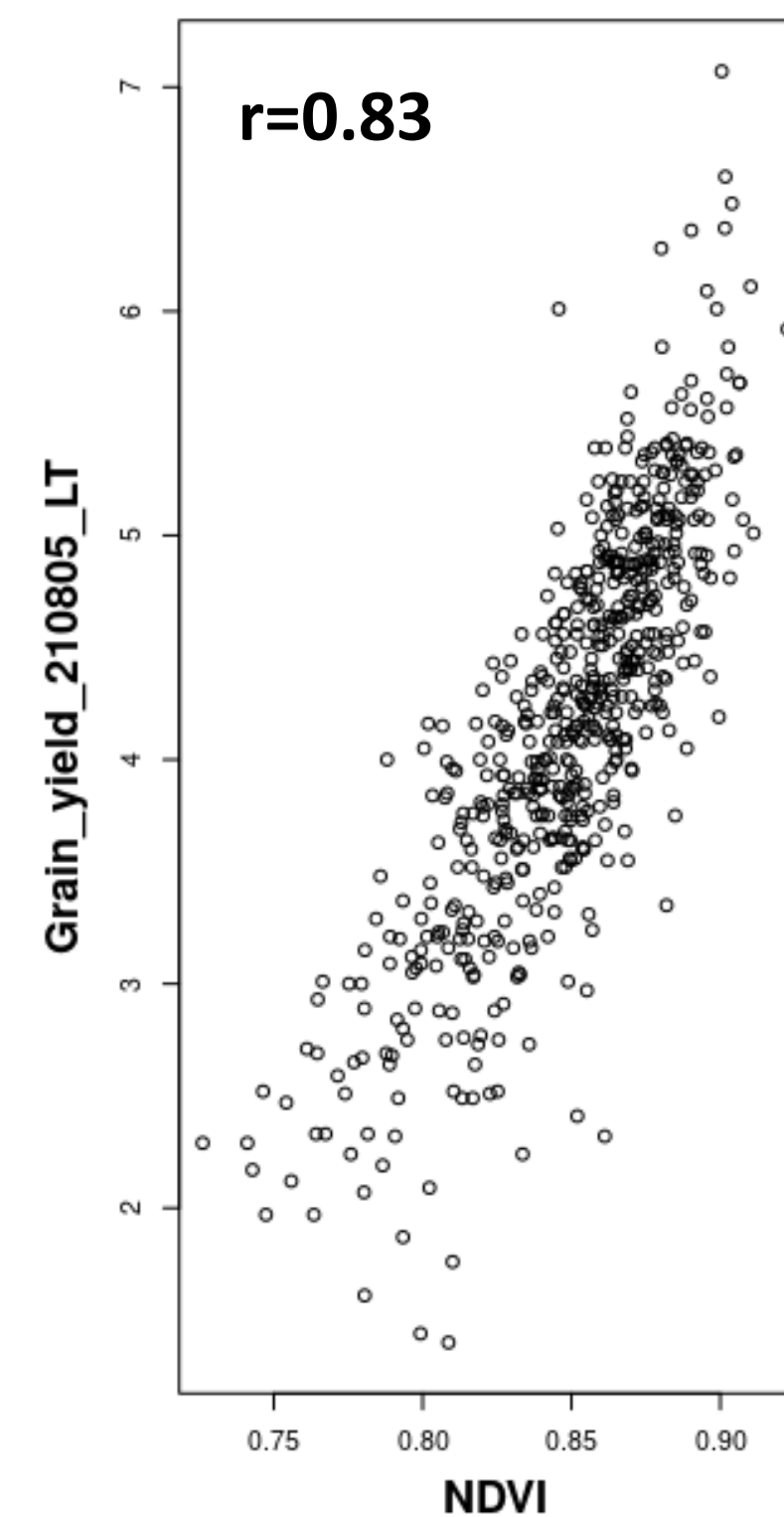
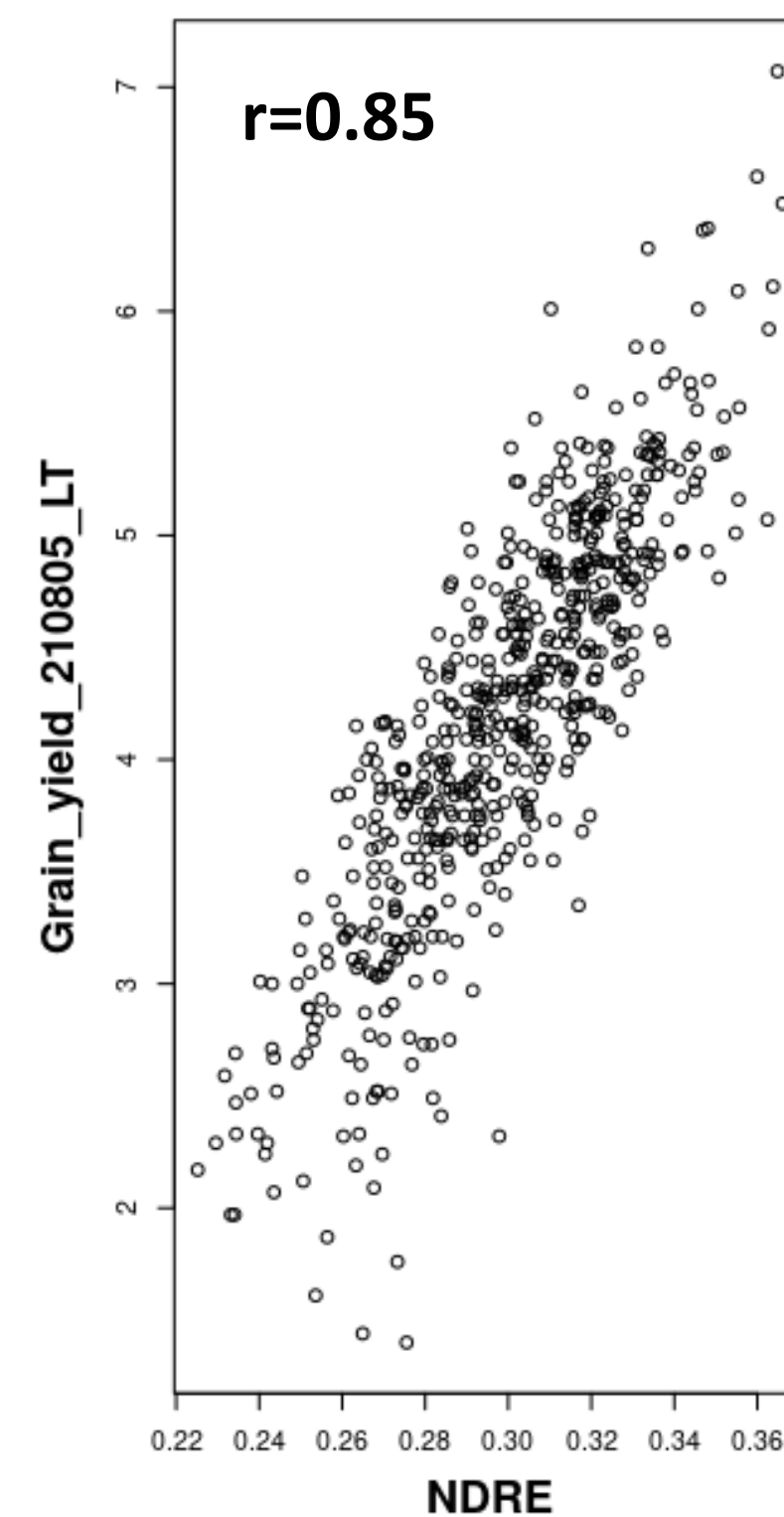
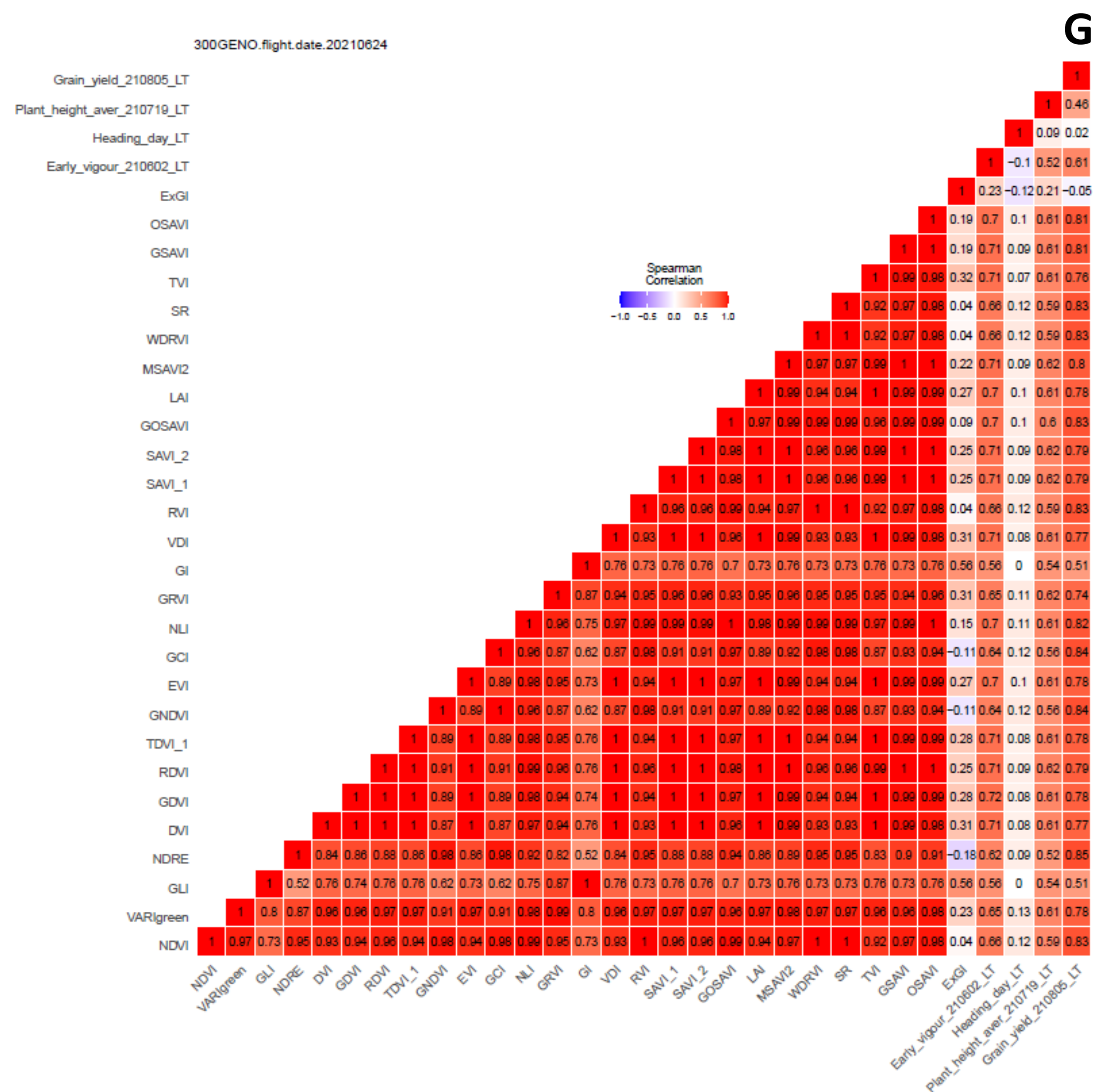




# UAV phenotyping: NDVI dynamics (LT site)



# UAV phenotyping: NDVI vs. grain yield (LT site)





# Phenocart phenotyping

LT

LV

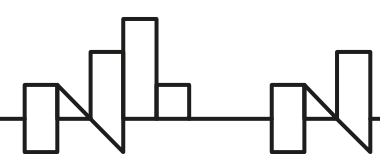
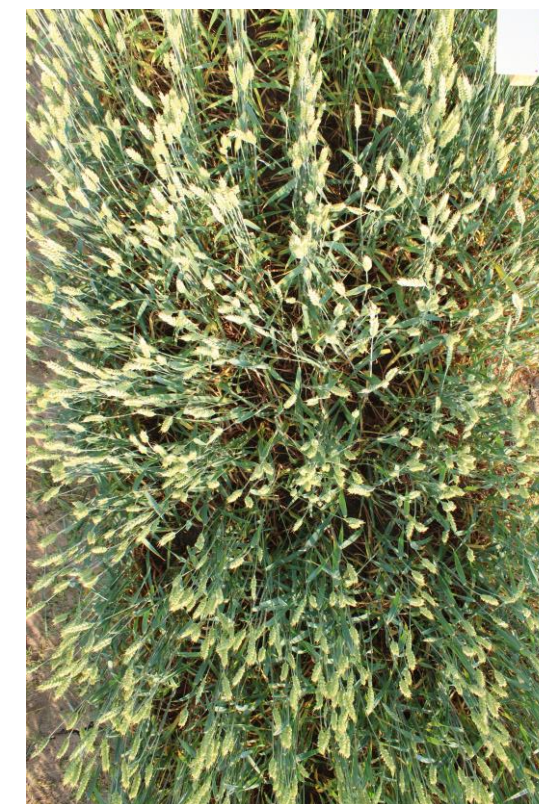
EE

NO

I (GS 21)

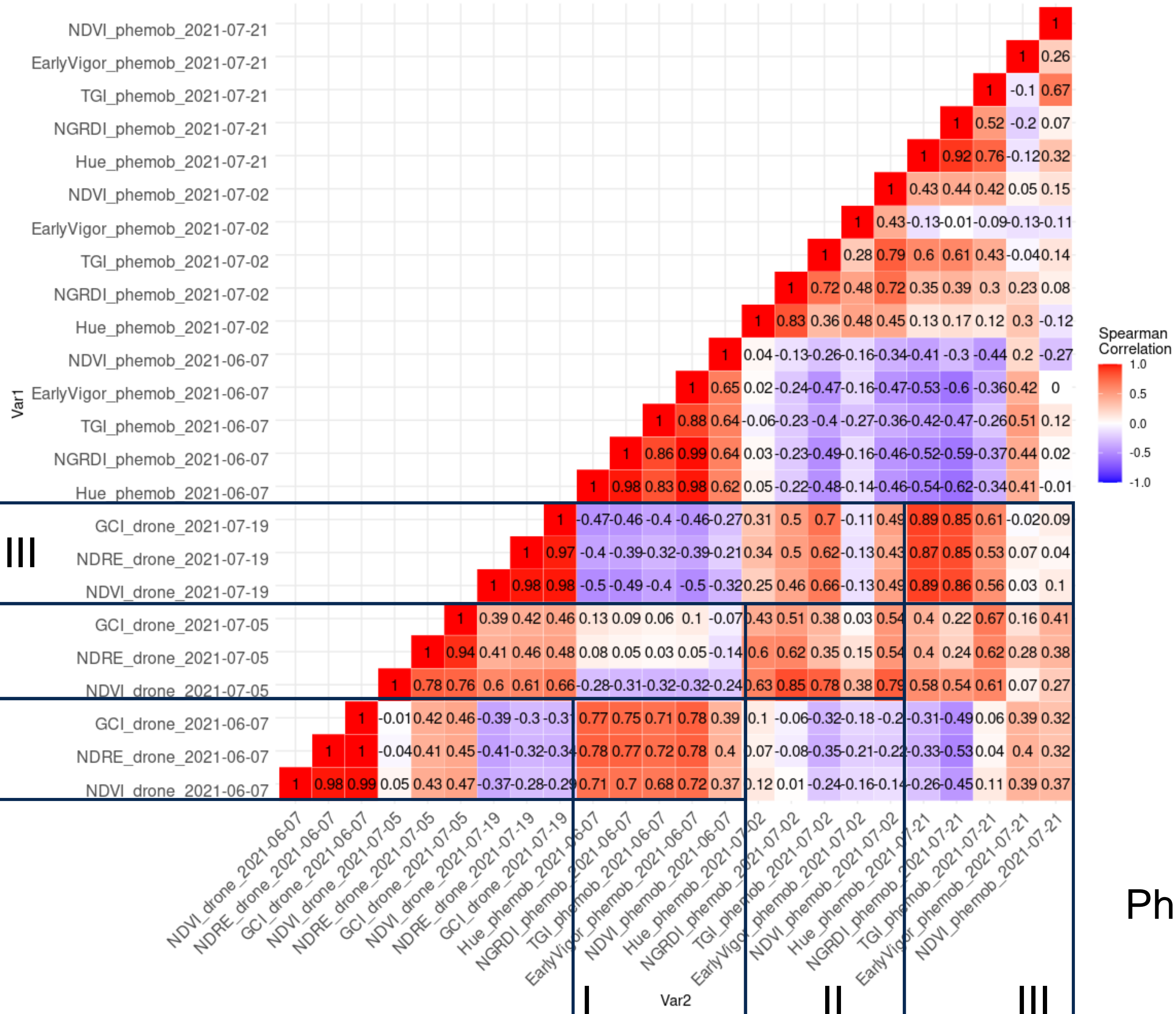
II (GS 65)

III (GS 71)





EE\_NUE75

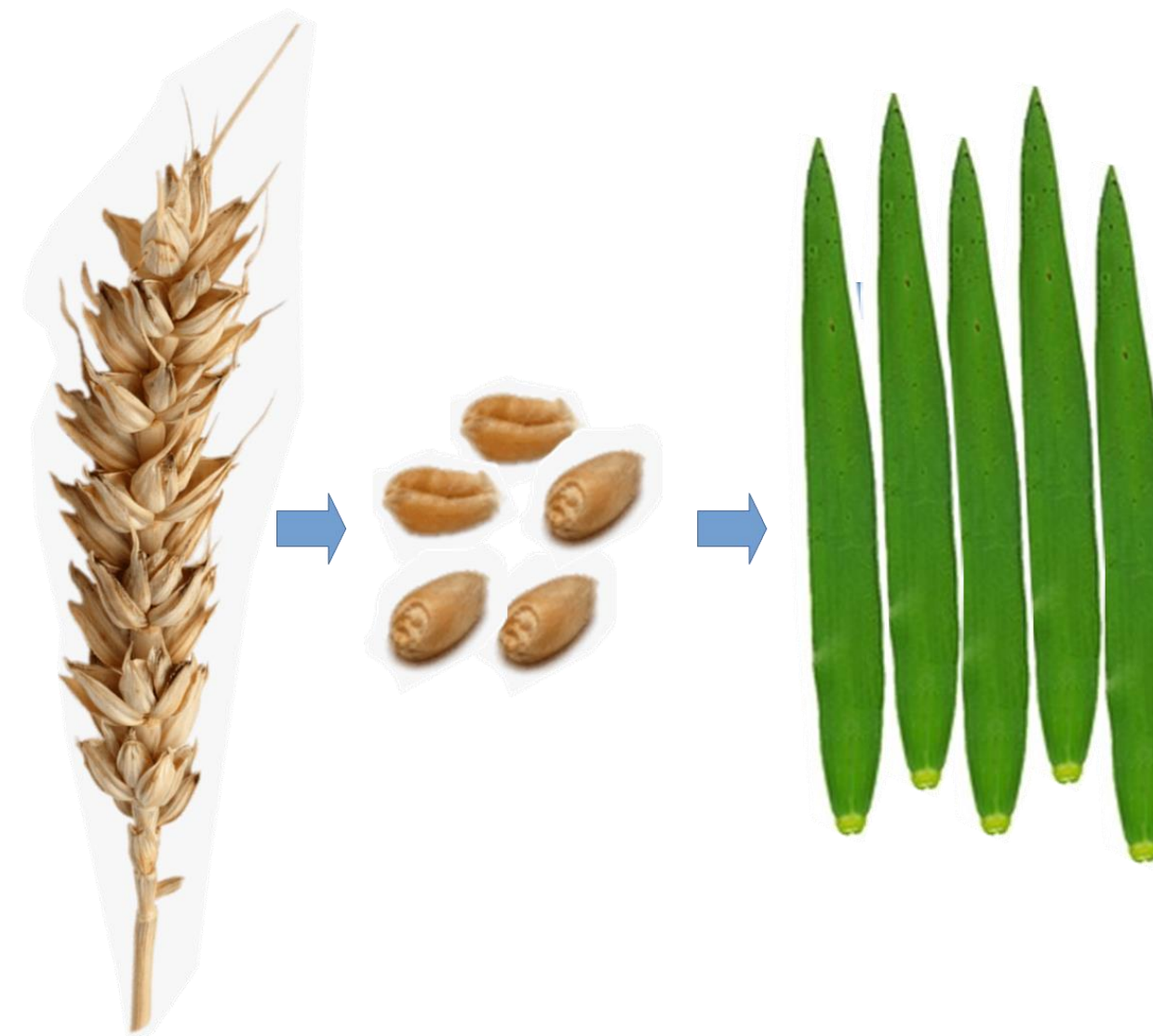


# Phenocart



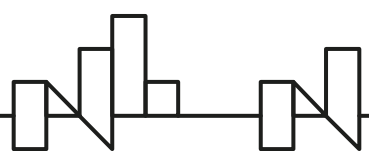
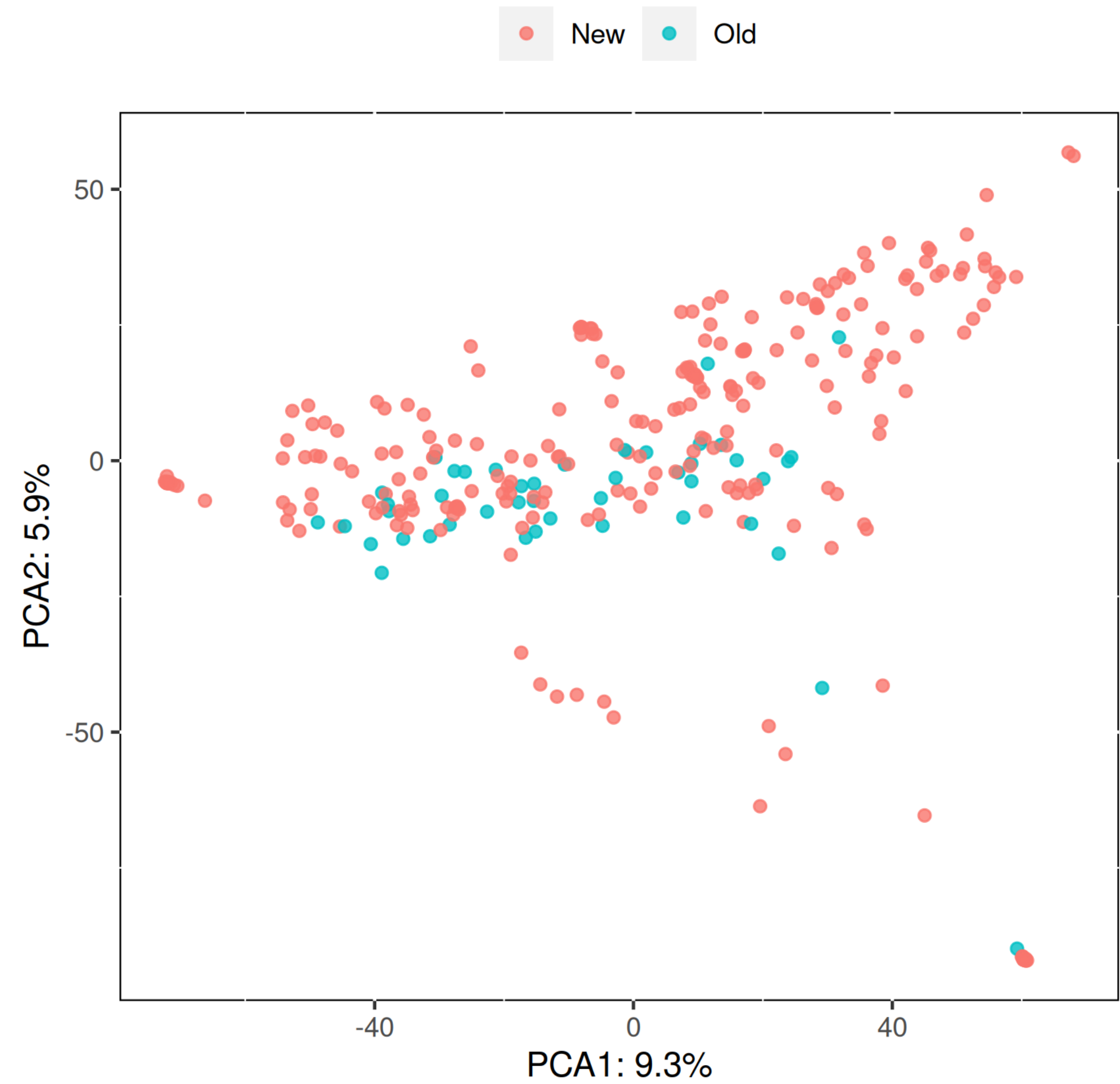
# WP3: Identification of QTL markers for traits of interest and implementation Genomic Selection into breeding programs

- ✓ 300 accessions were genotyped on 25K Infinium array (TraitGenetics)
- ✓ Genotypic data was QC-checked and filtered to ~18.733 of high-quality markers for further analyses



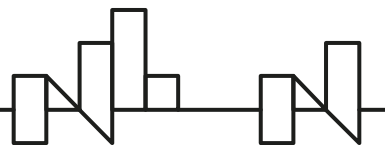
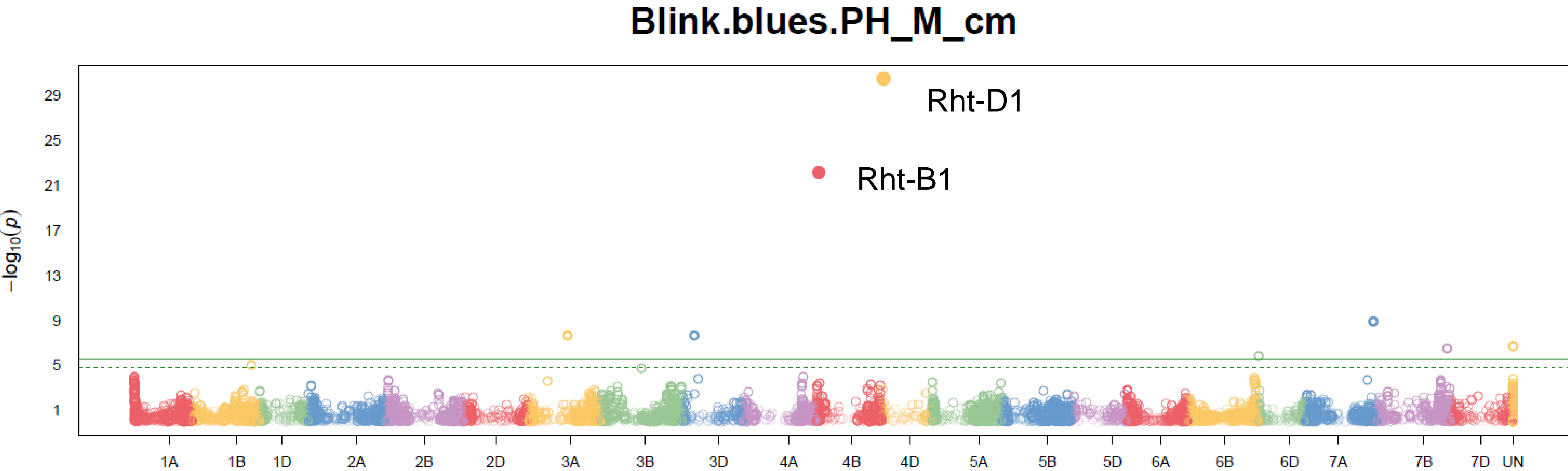
Pooled and genotyped  
on a 25 K SNP chip

# Genotyping: overall diversity

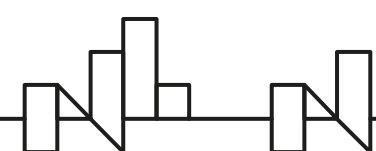
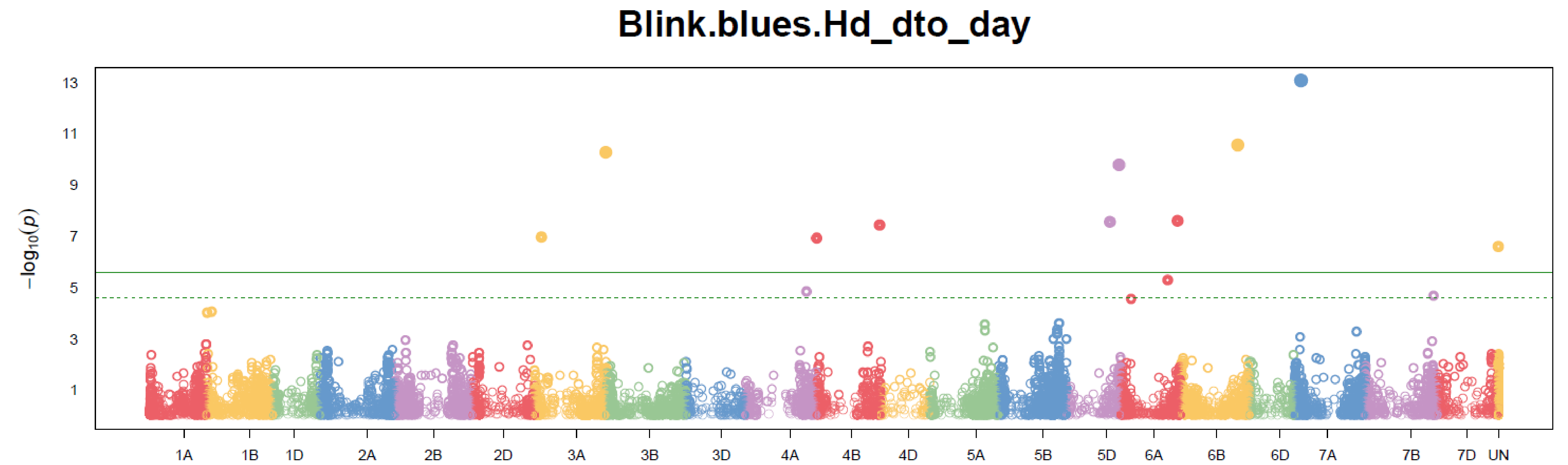




# GWAS: plant height

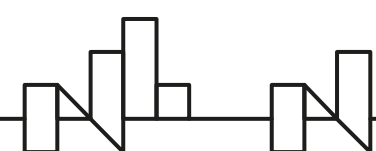
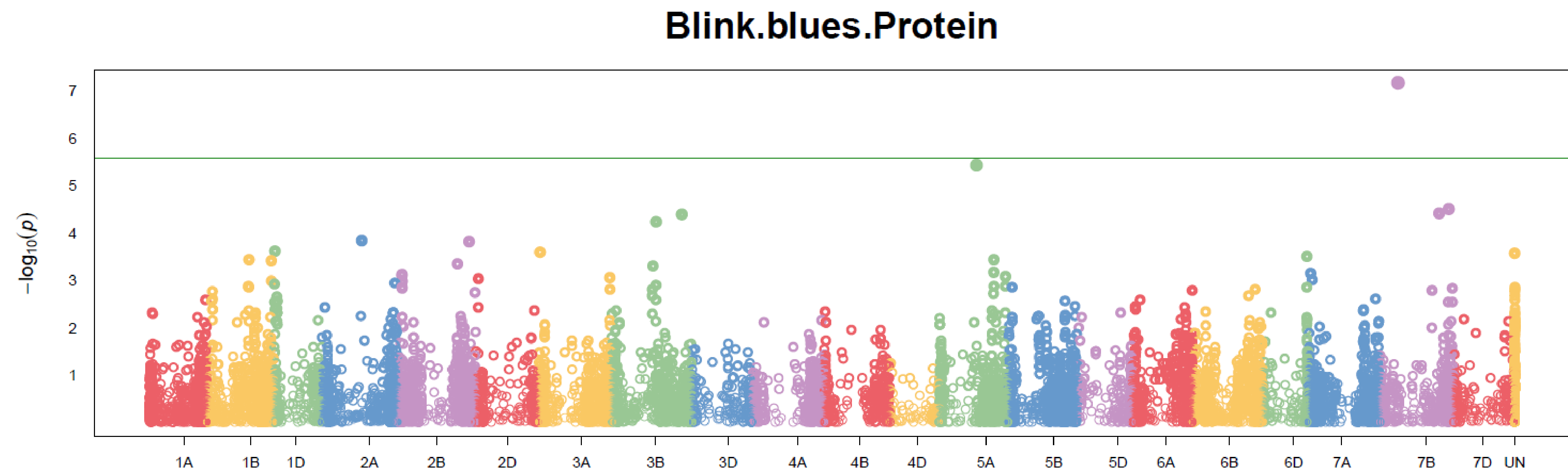


# GWAS: heading date

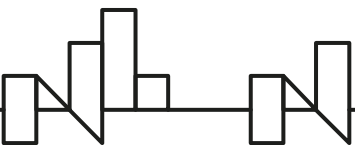
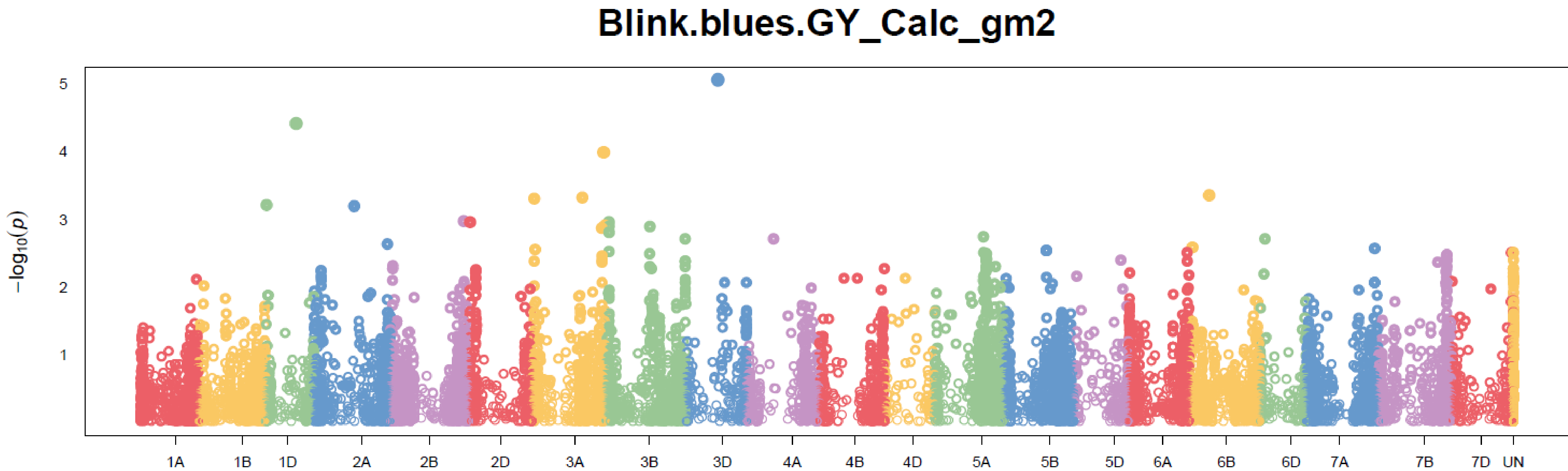




# GWAS: grain protein content

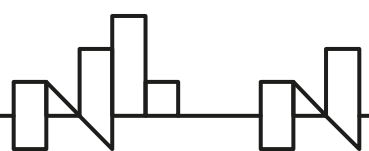


# GWAS: grain yield



# Next steps

- Season 3 data collection
- GWAS on UAV data
- GWAS on disease resistance
- NUE estimation
- Plant gas exchange
- Plasticity





# Thank you!

Working together for a **green**,  
**competitive** and **inclusive** Europe!

