

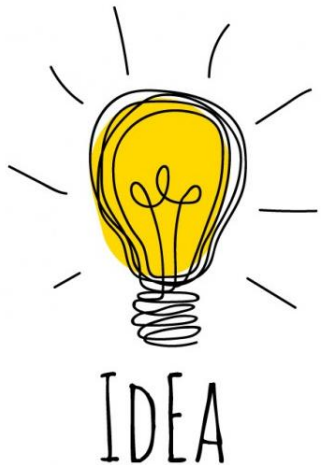
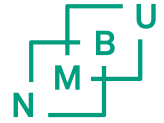
Examples of genomics and phenomics and to accelerate genetic gains in wheat breeding

Morten Lillemo



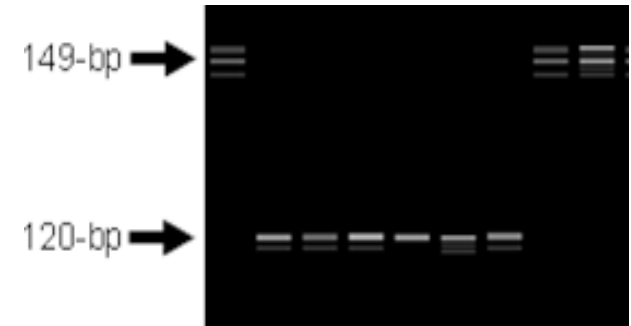
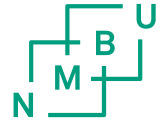
NPPN field day
June 17th, 2020

Wheat breeding as I learned it



15-20 years from crossing to cultivar grown by farmers

From SSR markers to whole genome sequence



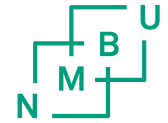
RESEARCH ARTICLE SUMMARY

WHEAT GENOME

Shifting the limits in wheat research and breeding using a fully annotated reference genome

International Wheat Genome Sequencing Consortium (IWGSC)*

Adventures in phenomics



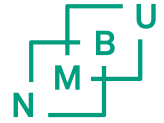
- Faculty of Biosciences



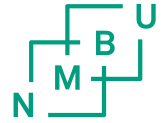
- Faculty of Science and Technology



Fun in the field with master students since 2016



Virtual phenomics



May 2017 – April 2022, Budget: 10.1 mill. NOK (\approx 1.1 mill EUR)

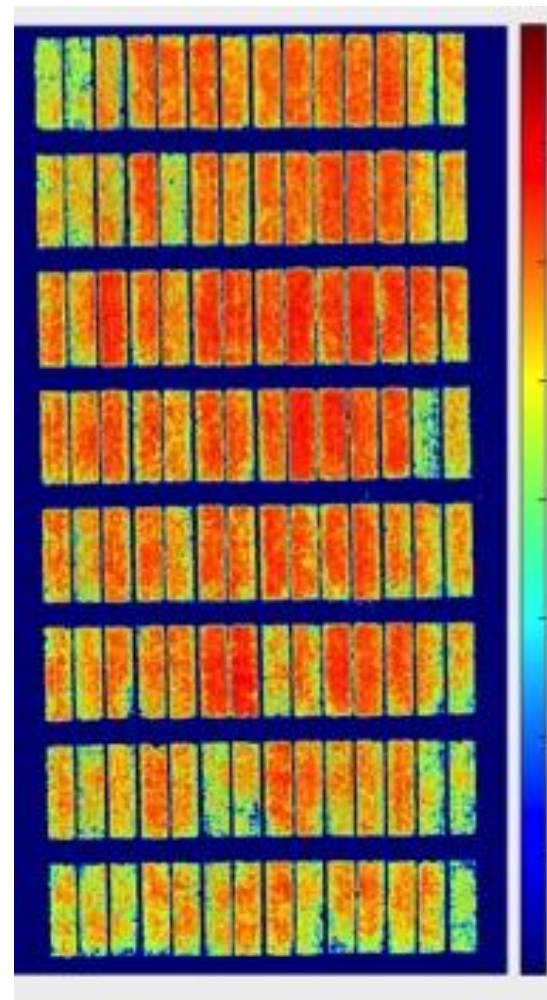




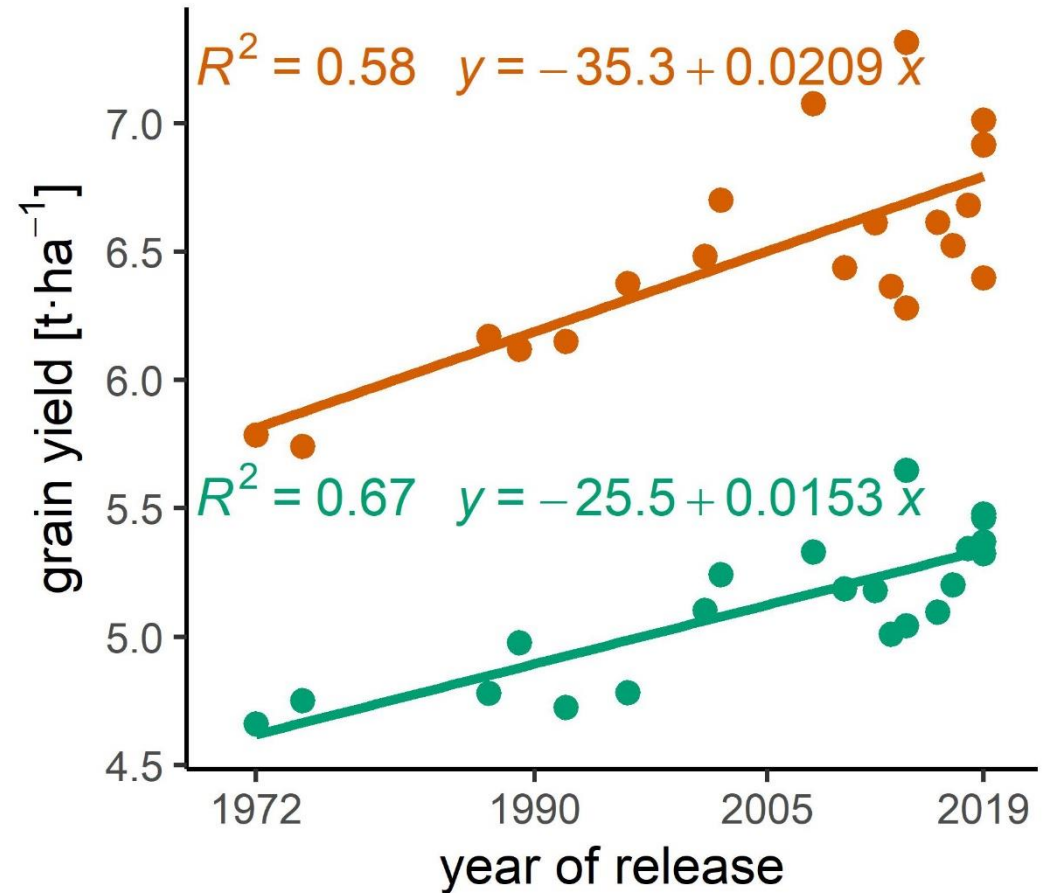
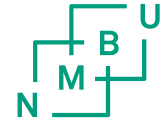
Comparing technologies in historical yield trial



- 24 historical cultivars grown at two N levels
- Compare drone and robot imaging with manual phenotyping
- Develop 3D models for virtual reality
- Investigate the physiological basis of grain yield increase



Comparing technologies in historical yield trial

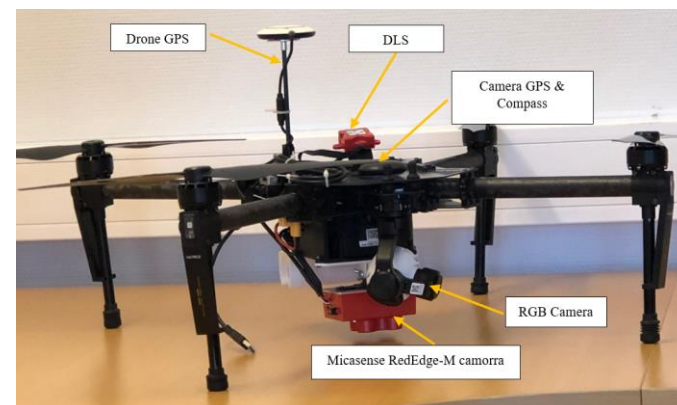


PhD student Tomasz Mróz

Prediction of grain yield based on multispectral imaging



Micasense RedEdge

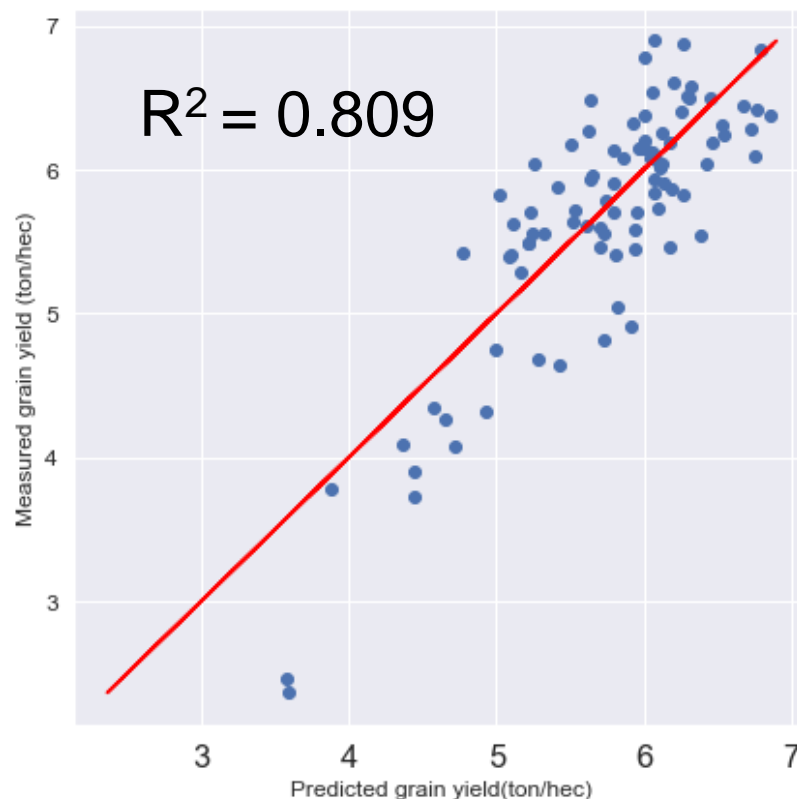
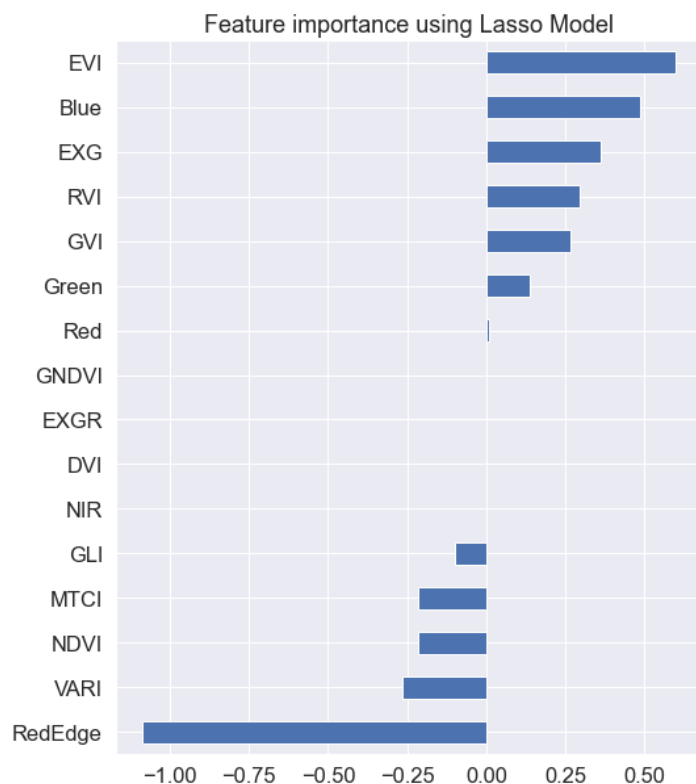


Matrix 100

Postdoc Sahameh Shafiee

Grain yield prediction

- 300 spring wheat lines – 2 reps in 2019
- LASSO based on «area under the curve»



Improved genomic prediction models

- Preliminary results based on yield trials with 300 spring wheat lines.
- Prediction accuracy of grain yield (correlation coefficients predicted vs observed):



Year	Only spectral bands	Only markers	Spectral bands + markers
2017	0.737	0.800	0.865
2018	0.658	0.781	0.822

Future direction: Prediction models for biomass



- Embedded field plots that will be harvested at anthesis
- Training of prediction models for biomass

Biomass plots

Biomass plots

Biomass plots

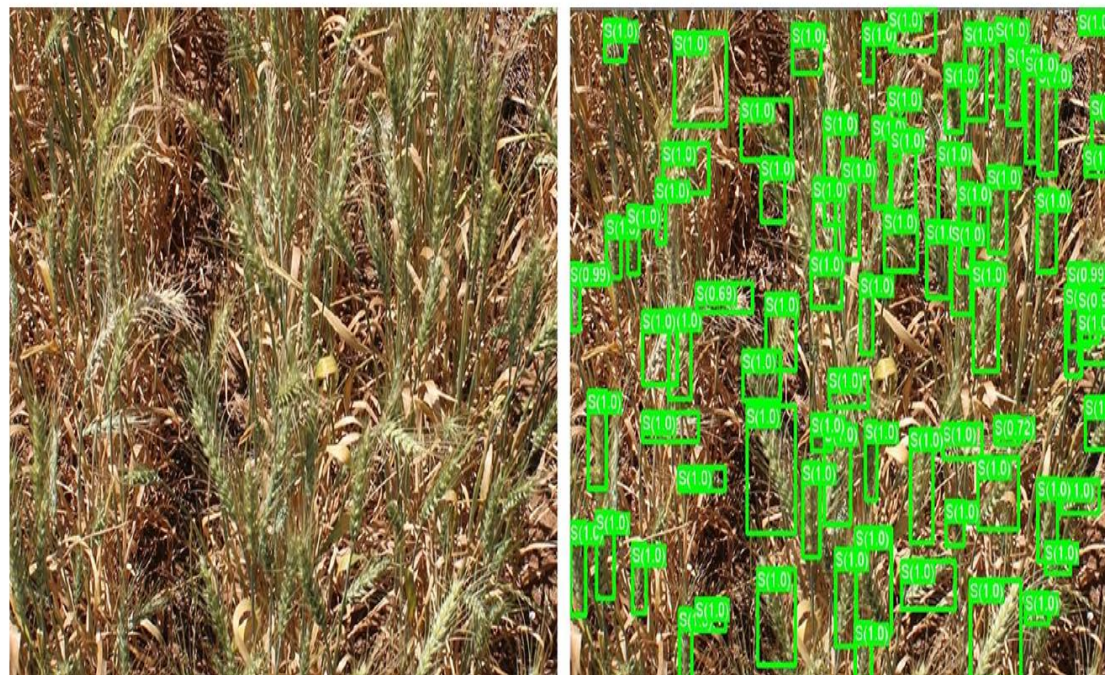
1501	1801	Biomasse	1503	1803
1505	1805		1543	1843
1547	1847		1547	1847
1540	1840		1582	1882
1543	1843	Biomasse	1584	1884
1547	1847		1586	1886
1547	1847			
1101	1401	Biomasse	1103	1403
1105	1405		1143	1443
1147	1447		1145	1445
1140	1440		1182	1482
1143	1443	Biomasse	1184	1484
1145	1445		1186	1486
1147	1447			

MASBASIS avlingsforsøk

MASBASIS avlingsforsøk



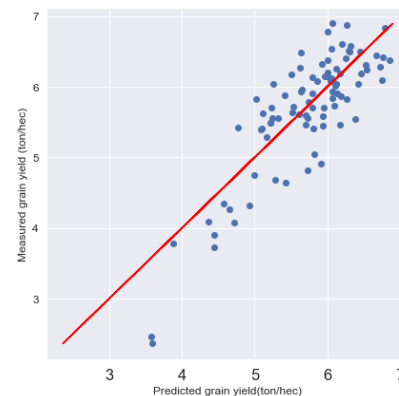
Future direction: Machine learning to count heads





Can we do this more efficiently?

15-20 years from crossing to cultivar grown by farmers



Enjoy the
bright future!

