



CULTIVATION, YIELDS AND QUALITY OF HERITAGE AND MODERN SPRING WHEAT VARIETIES



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QUALITY WHEAT GRAIN

- Background
- Aim
- Methods and results
 - Field trials
 - Baking test
 - Sensory test



BACKGROUND - BREEDING



PROJECT: «QUALITY GRAIN OF SPRING WHEAT FOR FOOD CONSUMPTION - OPPORTUNITIES IN NON-COMMERCIALIZED NORWEGIAN VARIETIES» 2016-2019

Aim

Preservation and use of a greater genetic diversity of cereals for food



**Focus: Accessions of spring wheat from the Norwegian breeding programme
Are they suitable for organic farming and artisan baking?**

Target group: The whole cereal value chain

SELECTION OF VARIETIES FOR FIELD TRIALS

By analysing early growth and their ability to cover soil surface



SELECTION OF VARIETIES FOR FIELD TRIALS

By analysing early growth and their ability to cover soil surface



FRAM II



NORRØNA

Varieties/accessions from Graminors field trials on organic farms



Variety/accession	Comments
1 Dala Landhvetet	Old and modern varieties
2 Fram II (1940)	
3 Norrøna (1952)	
4 Møystad (1967)	
5 Runar (1972)	
6 Polkka (1992)	
7 Sport (1994)	
8 Mirakel (2012)	
9 GN03503	Selected based on foliage soil coverage
10 Seniorita (2014)	
11 GN06557	
12 GN10603	
13 GN12741	
14 GN12759	
15 GN12760	
16 GN13618	
17 GN14529	
18 GN14649	
19 GN12634	Selected based on organic field trials
20 GN15621	
21 GN16503	
22 GN17632	New accessions with «soft» gluten
23 GN17633	
24 GN17634	
25 GN17635	

Field trials in Trøndelag in 2017 and 2018



25 varieties/accessions

- Plots of 1,5 x 8 m
- 2 blocks per field
- 2 sites per year

Registrations:

- Growth and health
- Yield
- Grain quality
- Baking quality
- Sensory test

ABOUT THE FIELD TRIALS

2017

- Good quality of the field trials
- Good yields and grain quality
- Weeds at hard dough stage: 5 %
- Some Septoria nodorum

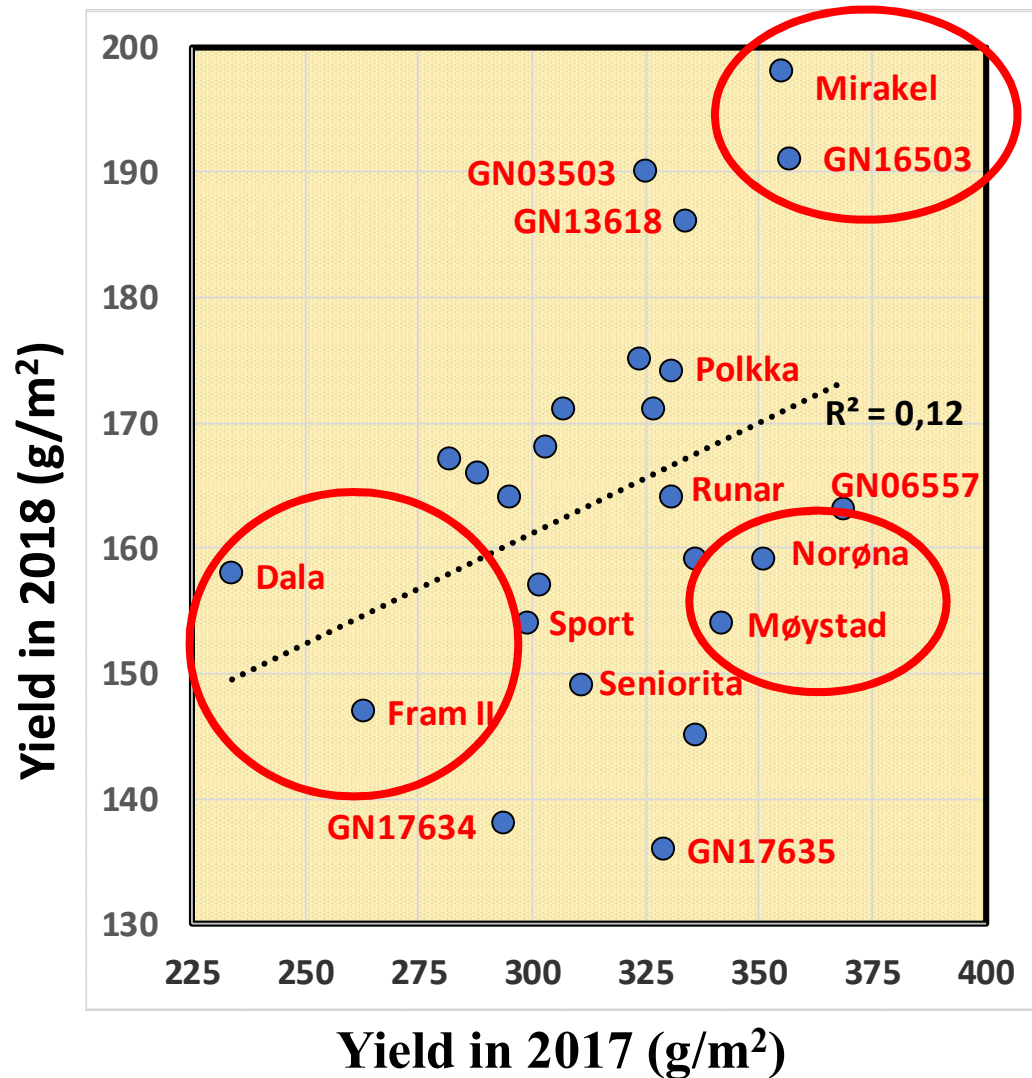
2018

- Good quality of the field trials
- Low yields and bad grain quality due to summer drought and high precipitation in autumn
- Weeds at hard dough stage: 16 %
- Aphids

	2017-1	2017-2	2018-1	2018-2
Yield (t/ha)	2.8	3.6	2.2	1.0
Water (%)	24	21	41	34

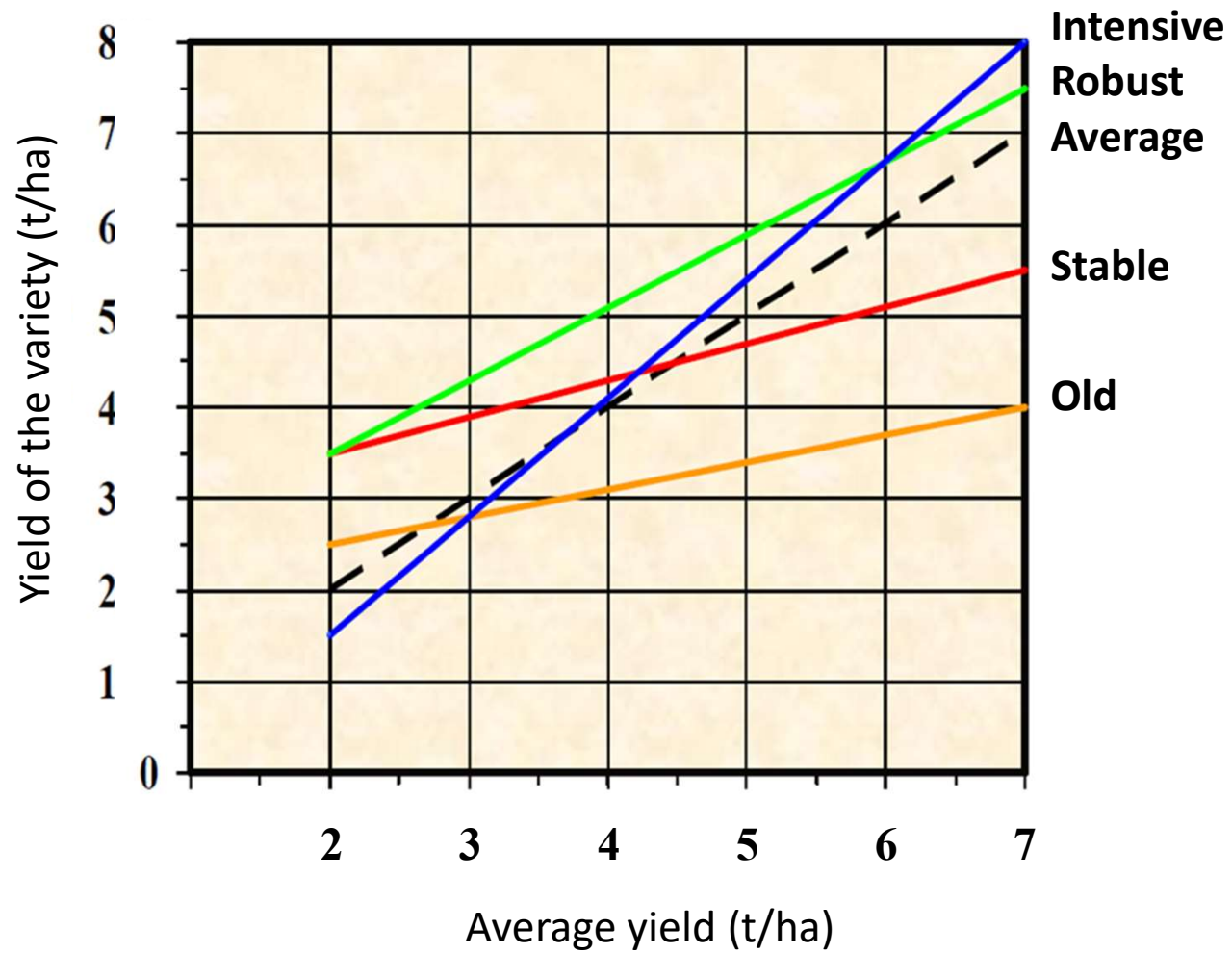


THE RELATIONSHIP BETWEEN GRAIN YIELD IN 2017 AND 2018

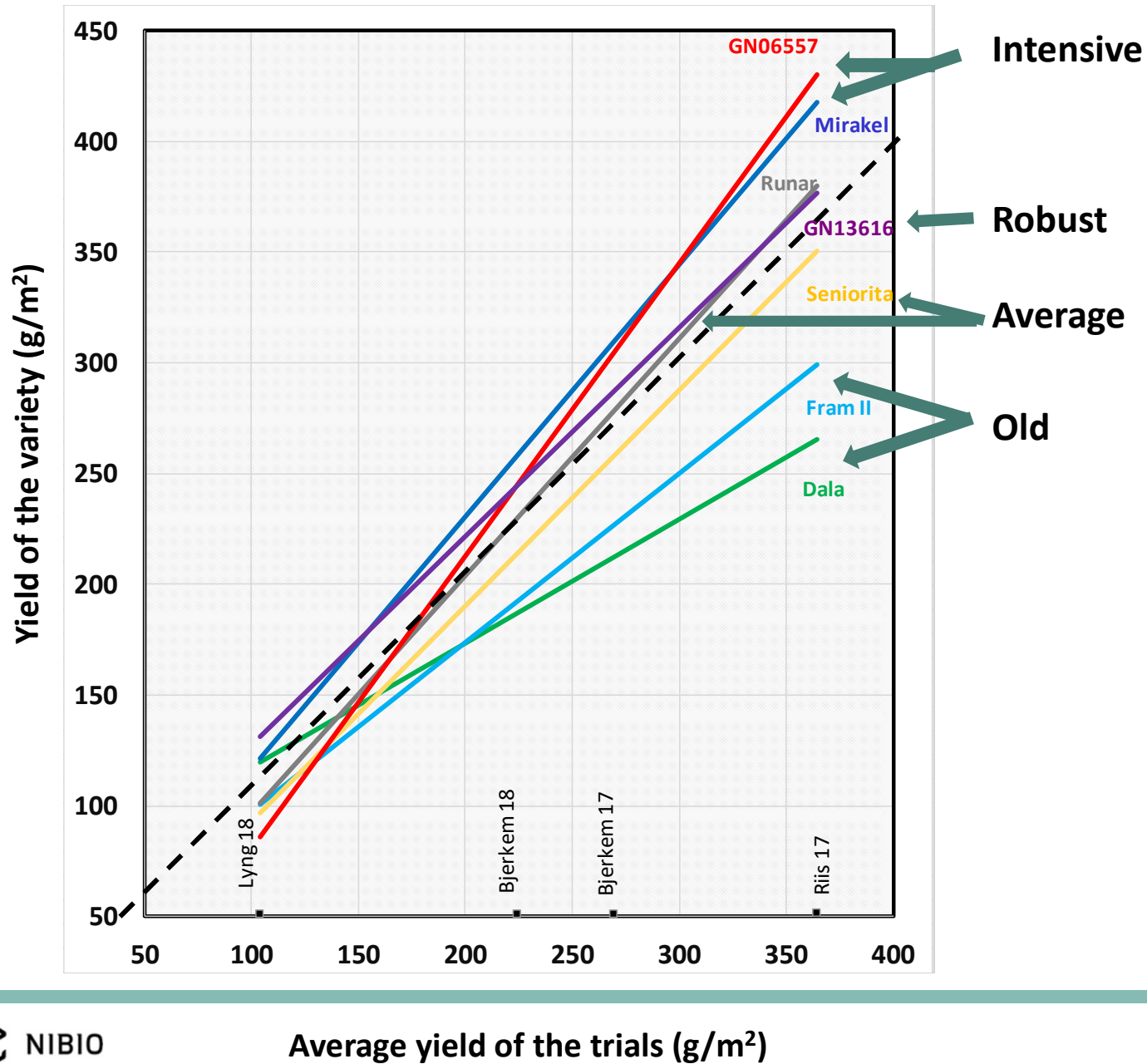


- Low correlation between grain yields in the two growing seasons
- Some new varieties gave high yields in both growing seasons
- Some old varieties gave low yields in both growing seasons
- High yields of the older varieties Norøna and Møystad in 2017

YIELD STABILITY OF VARIETIES



YIELD STABILITY OF VARIETIES



RESULTS – FIELD TRIALS

Oldest varieties:

- Longer straw
- Poorer straw strength
- Pre-harvest germination of the grains

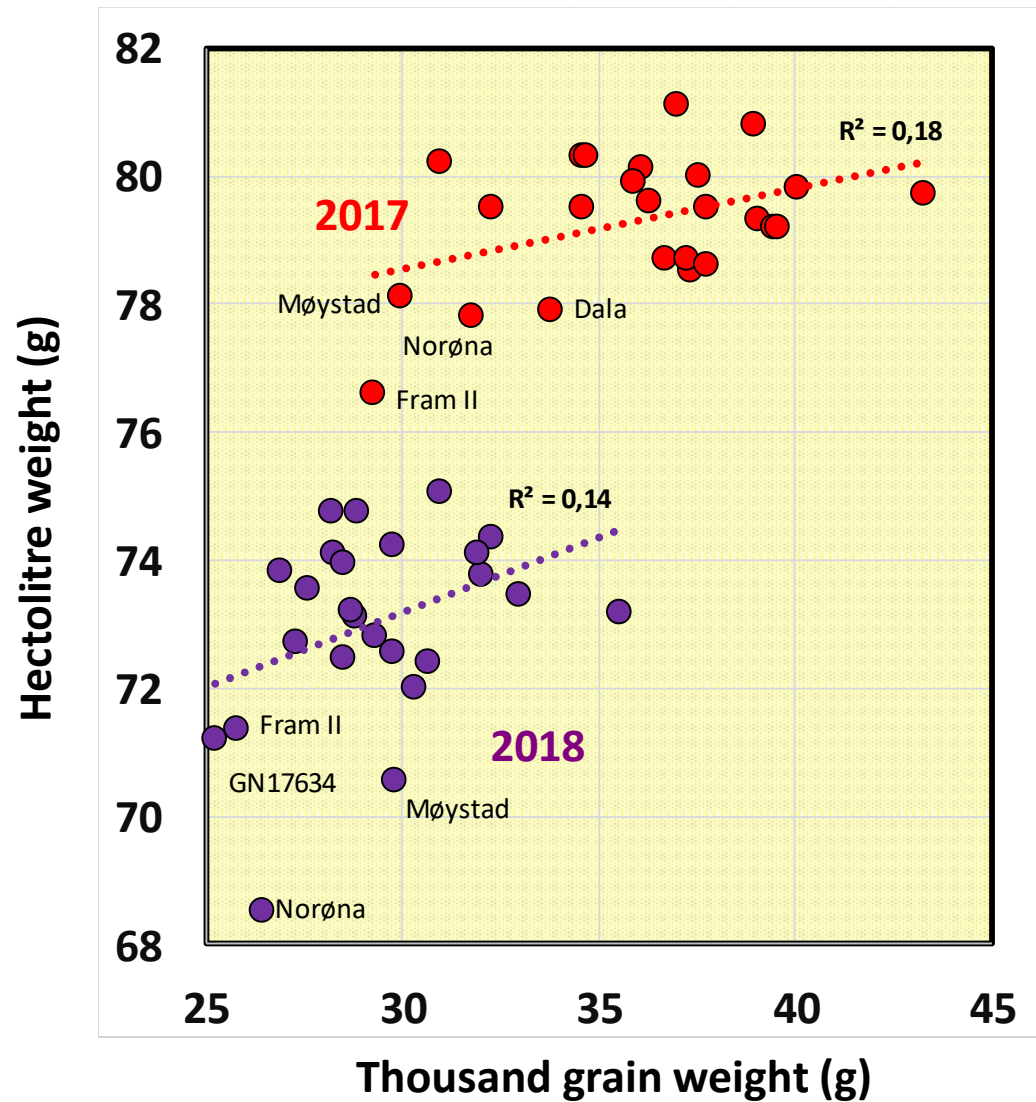
More stabile falling numbers among the modern varieties and accessions

	Lodging (%)				Straw lenght (cm)		Falling number (s)			
	17-1	17-2	18-1	18-2	2017	2018	17-1	17-2	18-1	18-2
Dala Landhvetet	97	100	60	0	114	93	156	139	62	146
Fram II	100	100	100	0	113	82	157	260	65	234
Norrøna	35	50	63	0	105	84	211	176	62	79
Møystad	60	80	63	0	105	81	229	170	62	65
Runar	3	0	3	0	99	72	304	272	86	107
Polkka	3	3	0	0	89	74	292	281	62	85
Sport	3	0	0	0	95	72	160	246	67	63
Mirakel	4	5	3	0	98	71	277	306	75	234
GN03503	0	0	3	0	92	69	293	282	158	219
Seniorita	0	50	10	0	87	66	279	291	107	189
GN06557	5	3	0	0	84	65	299	373	123	216
GN10603	0	0	8	0	86	66	302	276	137	157
GN12741	1	0	5	0	81	64	287	365	104	169
GN12759	0	0	0	0	90	70	389	376	104	290
GN12760	0	0	0	0	84	63	381	371	73	240
GN13618	10	0	0	0	82	70	275	316	70	123
GN14529	0	0	0	0	86	73	309	275	181	299
GN14649	0	0	1	0	84	61	346	316	182	236
GN12634	0	1	25	0	90	68	349	383	165	250
GN15621	5	0	15	0	86	64	277	299	63	205
GN16503	1	0	3	0	90	74	279	301	131	217
GN17632	0	0	0	0	88	65	243	257	111	236
GN17633	0	0	2	0	90	68	307	232	127	274
GN17634	0	0	0	0	82	62	147	152	62	133
GN17635	8	0	8	0	92	72	340	338	71	157

RESULTS – GRAIN QUALITY

Differs among growing seasons

In general, better grain filling and larger grains of the modern varieties

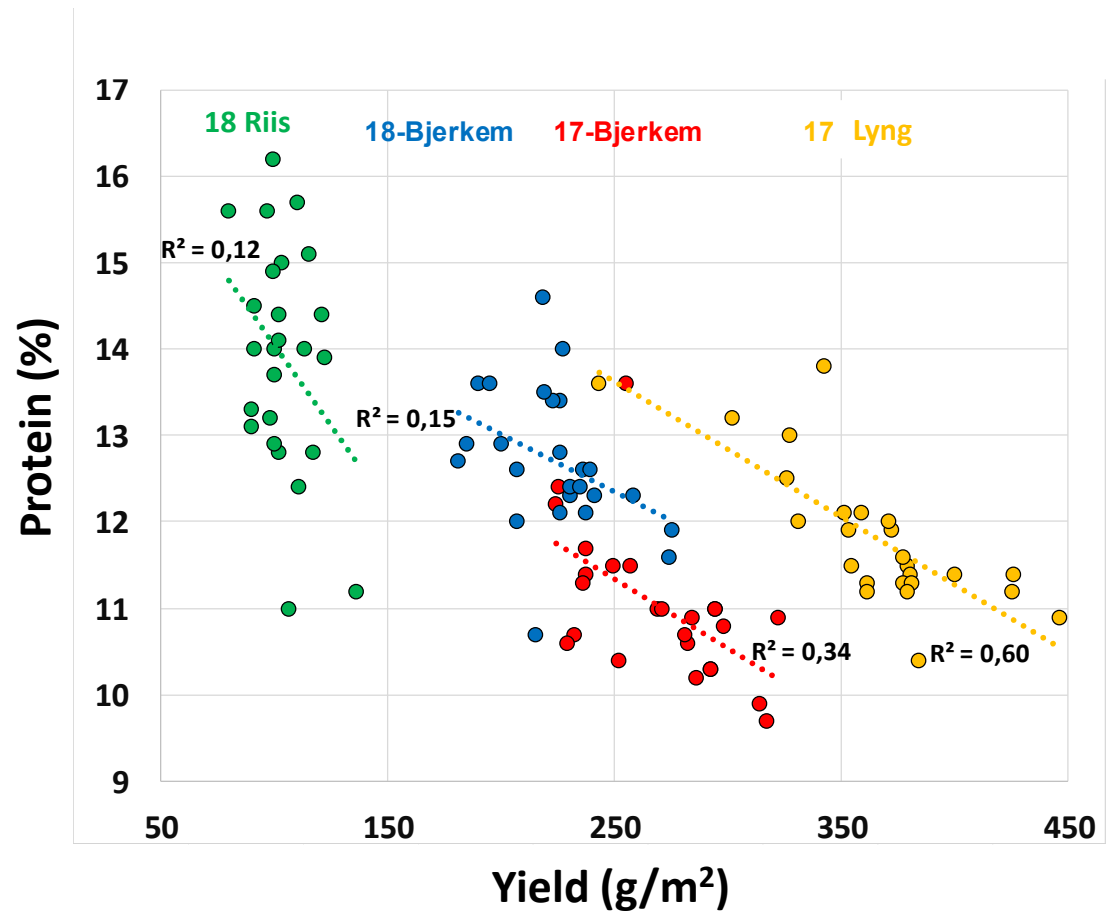


RESULTS – PROTEIN CONTENT

Differs among growing seasons:

2017: Negative correlation – dilution effect

2018: No correlation – drought hampered growth and uptake



RESULTS - PROTEIN

- Low yielding old varieties had higher protein content than the modern varieties, but lower protein yield
- Old varieties had weaker gluten than the modern varieties, with some exceptions among the modern accessions.

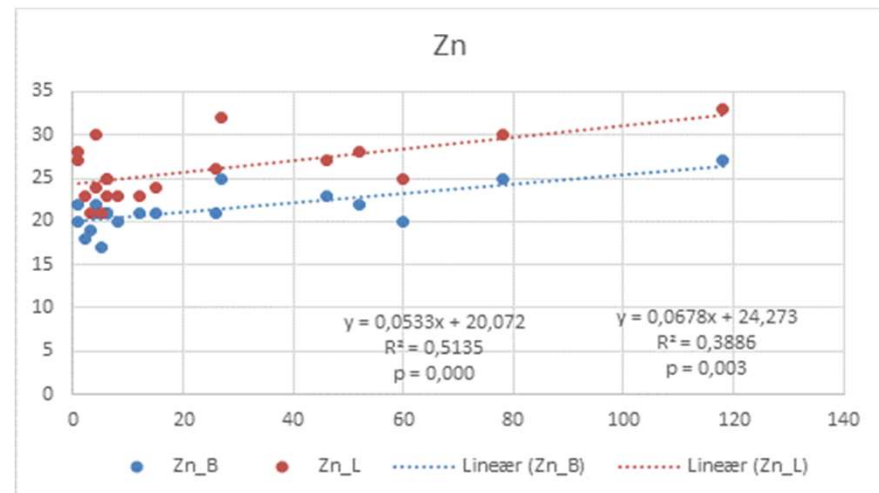
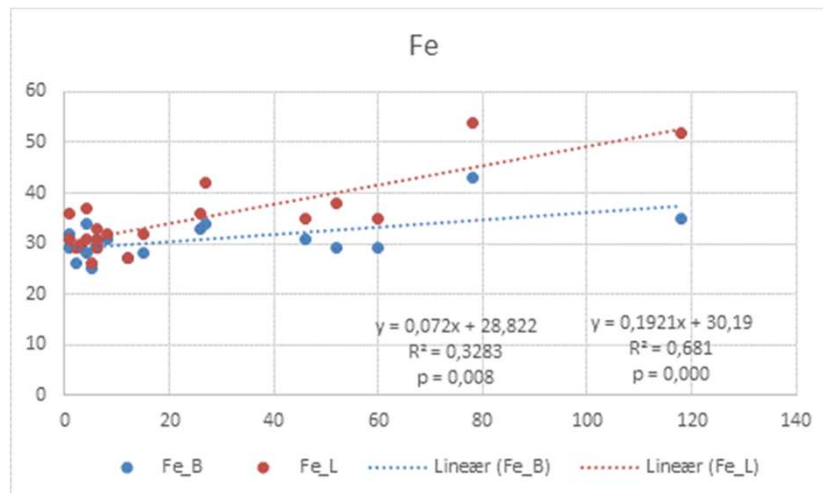
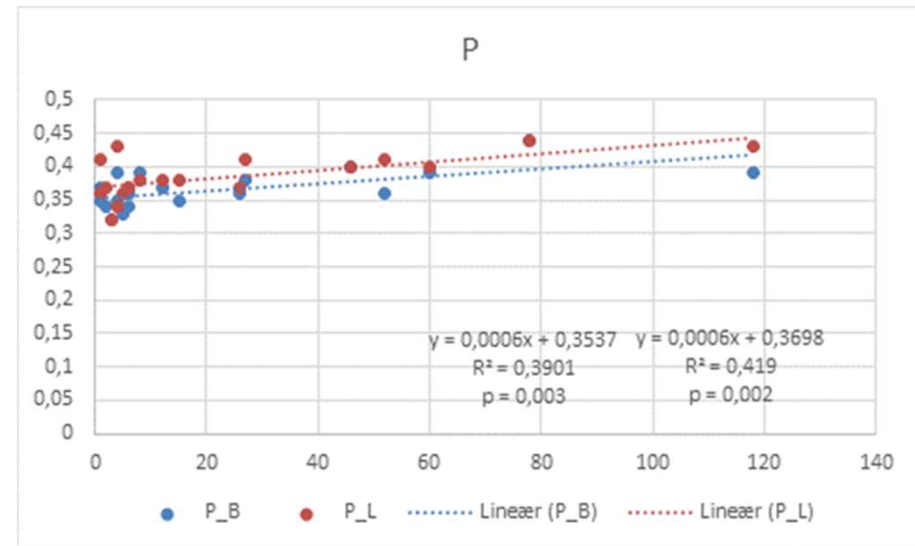
	Protein (%)		SDS-sed.		Specific SDS		
	2017	2018	2017	2018	2017	2018	Average
Dala Landhvetete	13.0	13.9	42	58	3.2	4.2	3.7
Fram II	12.7	14.3	30	48	2.4	3.4	2.9
Norrøna	10.1	12.2	45	57	4.5	4.7	4.6
Møystad	11.1	13.3	34	50	3.1	3.8	3.4
Runar	11.1	13.9	53	69	4.8	5.0	4.9
Polkka	11.3	12.6	57	62	5.0	4.9	5.0
Sport	13.7	14.8	62	72	4.5	4.9	4.7
Mirakel	11.2	12.8	75	79	6.7	6.2	6.4
GN03503	11.2	13.4	59	74	5.3	5.5	5.4
Seniorita	11.6	13.2	64	73	5.5	5.5	5.5
GN06557	10.6	12.5	66	77	6.2	6.2	6.2
GN10603	11.3	14.0	54	71	4.8	5.1	4.9
GN12741	11.2	13.0	63	81	5.6	6.2	5.9
GN12759	11.4	13.7	67	78	5.9	5.7	5.8
GN12760	10.9	14.0	67	80	6.1	5.7	5.9
GN13618	10.8	11.9	72	76	6.7	6.4	6.5
GN14529	12.0	13.8	64	72	5.3	5.2	5.3
GN14649	11.5	13.0	65	79	5.7	6.1	5.9
GN12634	12.4	14.3	63	80	5.1	5.6	5.3
GN15621	10.8	12.4	68	74	6.3	6.0	6.1
GN16503	10.7	11.5	62	68	5.8	5.9	5.9
GN17632	11.0	13.5	64	73	5.8	5.4	5.6
GN17633	11.5	14.2	61	82	5.3	5.8	5.5
GN17634	11.8	13.7	55	65	4.7	4.7	4.7
GN17635	11.5	13.0	51	65	4.4	5.0	4.7

Average field 1	11.0	12.7	58	73
Average field 2	11.8	13.9	58	67

RESULTS - MINERALS

Minerals in grains from 2017:

- The levels were affected of site
- Higher contents of phosphorus (P), iron (Fe) and zinc (Zn) in the old varieties
- No clear correlation with age of the other minerals: S, K, Mg, Ca, Na, Cu, Mn and Mo



BAKING TEST - SOURDOUGH BREAD

20 varieties/accessions from each of the two field trials in 2017:

- Evaluation of the dough and the bread by Caroline Lindö
- The bread of modern varieties/accessions got the best evaluation
- Old varieties had quality characteristics interesting for produce of specific products

17TØkoTrø	Fall-	%	SDS-			
Sted	tall	Prot.	sed.	bedömning deg	bedömning bröd	
Dala Landhvet	B	156	12,4	41	spänstig och fin	Platt bröd med degrand
	L	139	13,6	42	mjuk, spänstig, stabil	Kompakt, klabbigt inkråm
Norrøna	B	211	9,7	44	Skör, kort	Platt, degrand
	L	176	10,4	45	mjuk och skör	Platt, ihopsjunken med degrand
Møystad	B	229	10,9	34	Lite stabbig, trög och tur	Fin form och harmoniskt inkråm förutom degrand
	L	170	11,3	34	mjuk och extensibel	Platt och ihopsjunken med kollapsat och degigt inkråm
Polkka	B	292	11,4	57	Fin och spänstig	platt, kompakt, liten degrand
	L	281	11,2	56	mjuk och extensibel mer	Lite lågt och kompakt, men bra bröd
Mirakel	B	277	10,9	74	Jättefin elasticitet och k	utmärkt, felfritt bröd
	L	306	11,4	75	Seg och lite tung men sp	Bra höjd, fint och lite tätt inkråm
GN03503	B	293	11,0	59	Lite stum och klistrig me	Lite lågt men utmärkt inkråm
	L	282	11,4	58	mjuk, lite instabil	Ganska platt men med fint inkråm
Seniorita	B	279	11,0	63	mjuk, spänstig	Fin form och harmoniskt inkråm
	L	291	12,1	64	mjuk, extensibel	Fin form och inkråm
GN17635	B	340	10,8	51	stark och spänstig	Fin höjd och fint inkråm
	L	338	12,1	51	mjuk, smidig och extensi	Bra bröd med fint inkråm, något underjäst

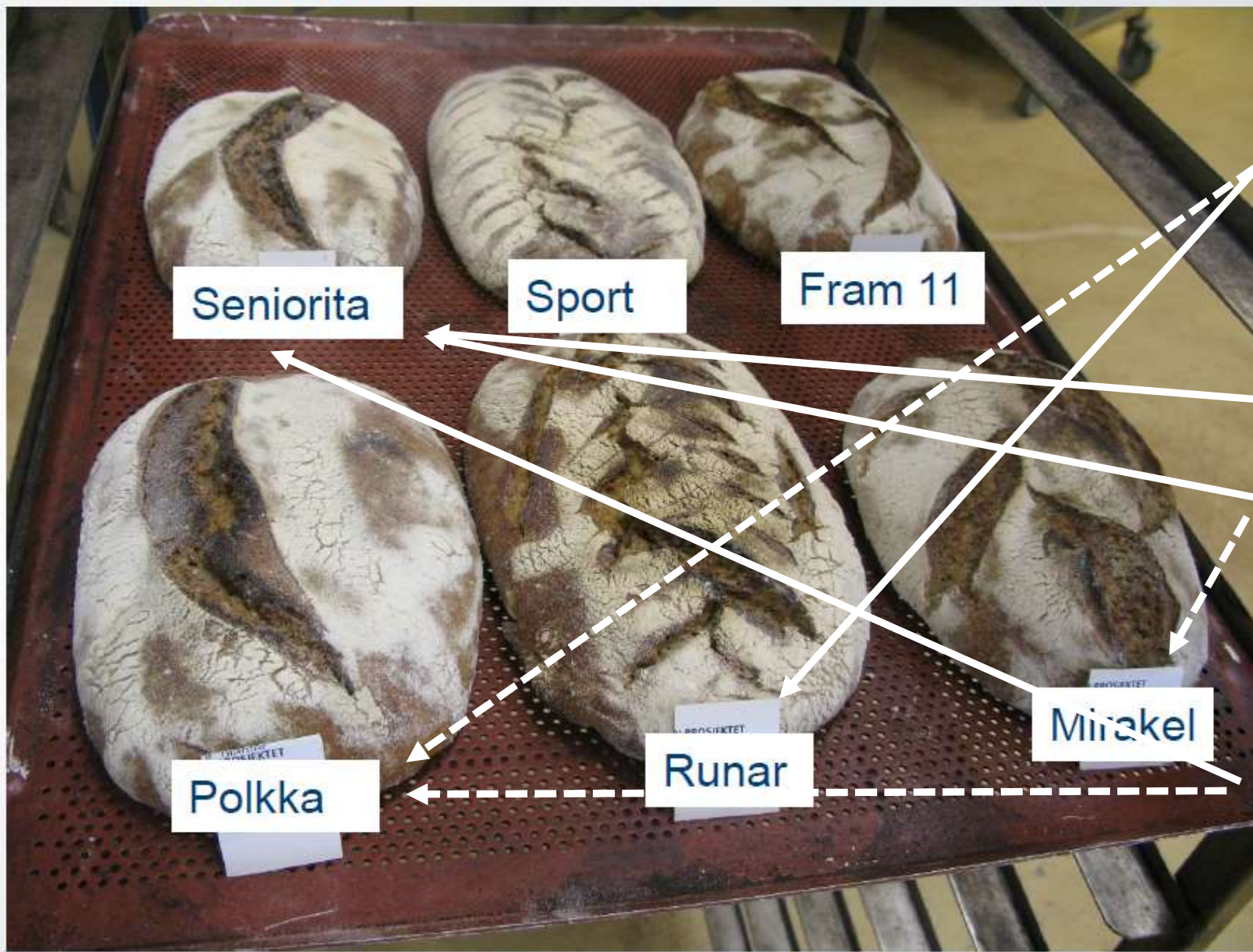


Norrøna



Mirakel

IS IT POSSIBLE TO SENSE THE VARIETIES IN BREAD?



TEXTURE:

- Firmness
- Hardness
- Juciness
- Chewing resistance
- Doughy

SMELL:

- Total smell
- Sourish
- Vinegar

TASTE:

- Total taste
- Sourish
- Sweet
- Salt
- Sour
- Bitter
- Umami
- Tasteless

SUMMING UP

Interesting non-commercialised varieties/accessions:

- Runar (1972): good yields, good breads, shorter growing season than the main variety on the market (Mirakel)
- GN17635 and GN16503: good combination of yield level, grain quality and baking quality
- The legislation provides opportunities for higher genetic diversity in organic cereal production:
 - Heritage varieties (> 10 years)
 - Accessions can be used in a “closed system”
 - Heterogeneous genetic materials (populations)

THANK YOU FOR YOUR ATTENTION

