NIBIO

NORSKØL

Norwegian malt, hops and herbs- the taste of Norwegian beer 2013-2016

Northern Cereal, Orkney 2015

v. Mette Goul Thomsen

Project organization

- 4 year innovation project, 2013 -2016
- Project owner NøgneØ - brewery in near cooperation with 12 other micro breweries, 3 traditional breweries and Norwegian homebrewers organization (NORBRYGG)
- Research partners: NIBIO project leader R. Eltun; M. Aasveen.

  Graminor AS
- Co-operation with international malting and brewing experts
- The project is financed by The Research Council of Norway and the project participants (total 4,5 mill NOK)

Aim of project

Knowledge building into Norwegian raw material – barley, hops and herbs for brewing. Emphasis on cultivars, cultivation and quality.

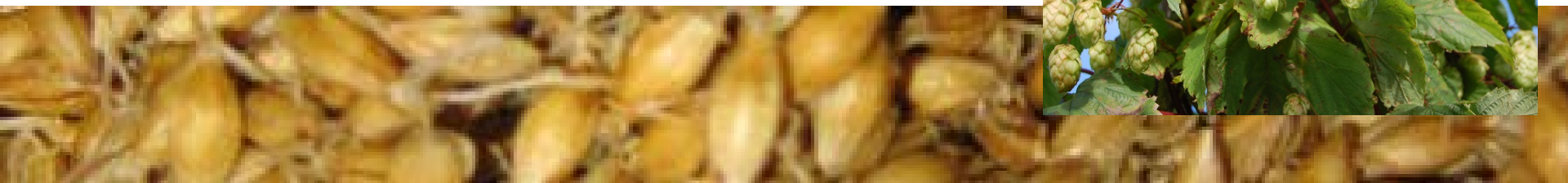
1. Select barley cultivars suitable for cultivation in Norway and analyse their malting and brewing qualities.
2. Select Norwegian hop clones suitable for cultivation in Norway and analyse the brewing qualities
3. Establish new knowledge on herbs for brewing. Genetic and geographic variation in selected species. Test of taste quality and effect on 'shelf life' in beer.
4. Establish competence into malting and perform financial - and market analysis.
5. Knowledge from the project will be distributed through seminars, guidelines and knowledge base.

Norwegian brewing - raw materials

- Malt production, 1980ies last malting house.
- Continued production in Trøndelag (middle Norway) of smoked malt
- Hop production 1100-1880. 1926 last trials in southern N

New trends :

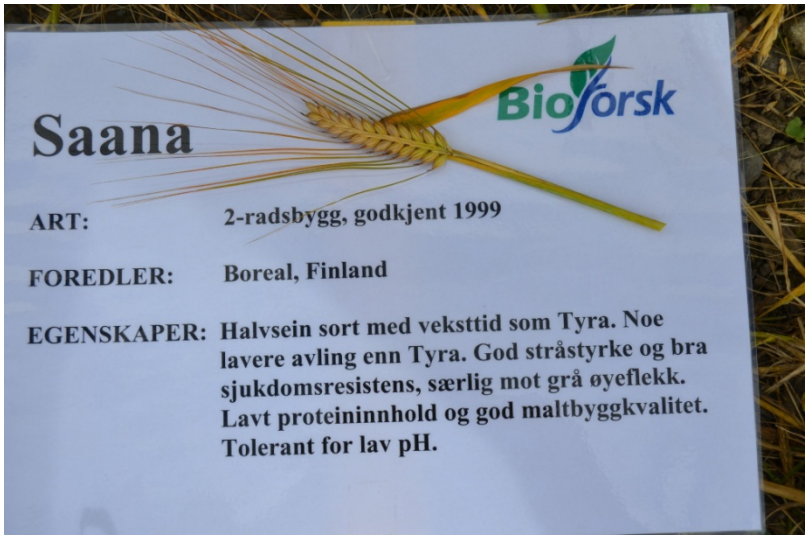
- New Nordic Food
- Local produces, old varieties, storytelling
- Larger variations



Barley

- Cultivars adapted to the growing conditions
- Length of growing season
- Quality requirements for malting

- Can we recreate a Norwegian beer with old barley cultivars?



Barley trials

- Cultivar testing conventional growing (Apelsvoll, Landvik, Kvithamar, Løken)
- Cultivar testing organic growing (Apelsvoll)
- N-fertilization and cultivar trials (Apelsvoll)
- Tested cultivars: Maskin, Varde, Domen, Arve, Olsok, Dønnes, Jotun, Lilly, Tiril, Saana, Marthe, Barke, Quench, Tamtam
- Analysis: General cereal analysis, malting analysis, kernel size fraction

Yield in conventional trials 2013 & 2014

Cultivar	N-kg/daa	Days to ripening	Length of straw	Kg/daa	Hl weight, kg	1000 kw, g	Protein, %
Domen (2)	8	104	72	526	72,2	47,7	10,3
Maskin (6)	8	95	80	547	70,4	37,3	10,5
Varde (6)	8	97	74	573	69,6	36,4	10,0
Arve (6)	8	96	67	599	68,3	38,7	9,4
Olsok (6)	8	96	69	588	68,5	38,6	9,6
Saana (2)	10	103	72	566	70,9	47,2	10,5
Barke (2)	10	105	58	563	71,7	48,1	10,4
Marthe (2)	10	106	60	611	71,6	47,3	10,3
Quench (2)	10	108	50	637	71,1	49,1	9,4
Tamtam (2)	10	107	58	638	70,5	49,7	9,6
No. of trials	5	5	5	5	5	5	5

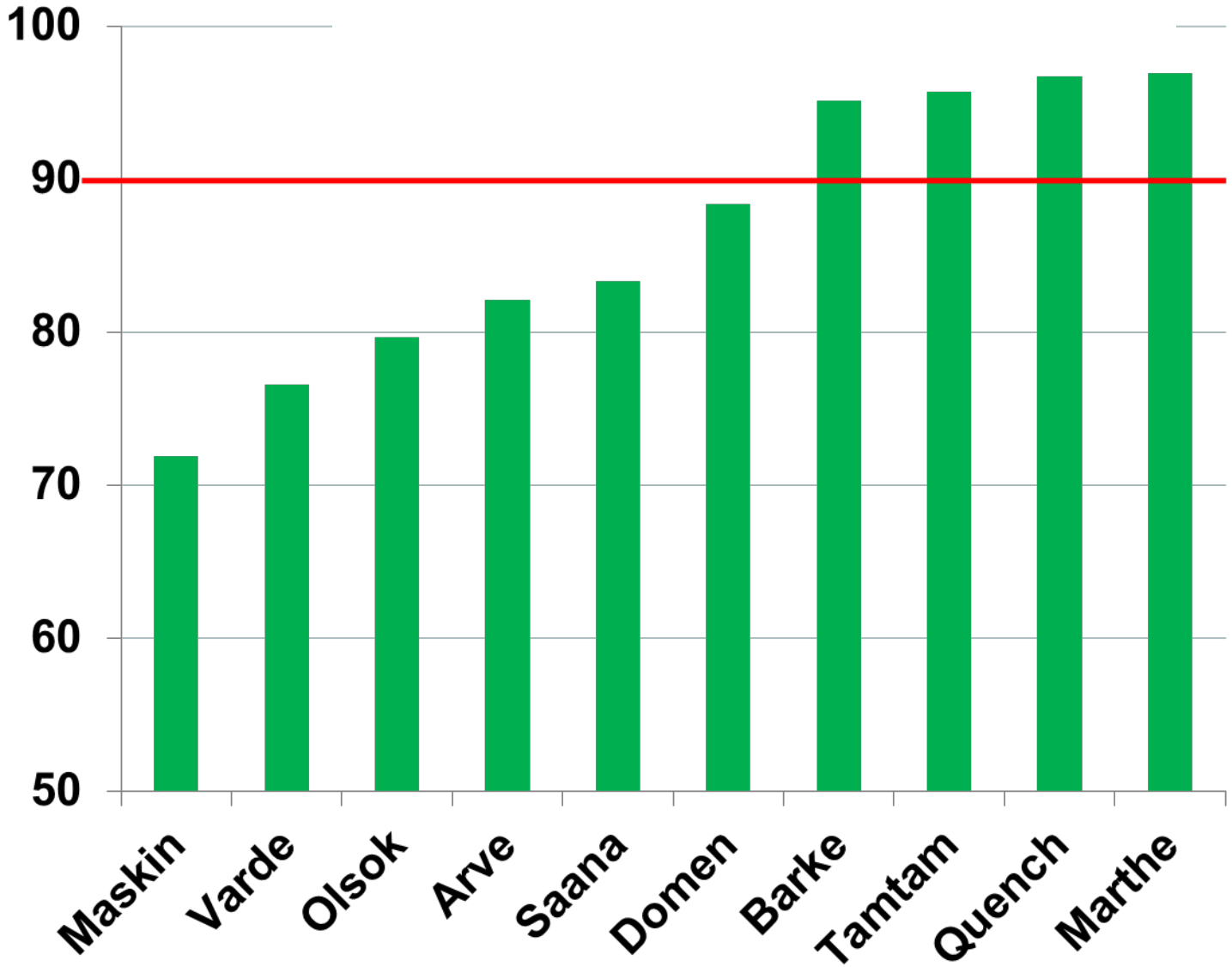
Yield in organic trials 2013 / 2014

Cultivar	N-. kg/daa	Length of straw cm	Yield kg/daa	1000-kw g	Protein %
Maskin	8	85	283	33,3	9,7
Varde	8	84	280	32,3	9,4
Arve	8	64	297	32,9	8,9
Olsok	8	63	292	33,8	9,2
Domen	8	83	284	46,4	9,8
Saana	10	58	311	46,1	9,9
Barke	10	59	323	47,3	9,1
Marthe	10	55	383	46,3	8,6
Quench	10	56	353	47,1	8,6
Tamtam	10	58	378	47,3	8,4

Varieties and N-fertilizing, 2013 & 2014

Varieties & N-fertilizing	Cereal Yield		Hl-weight	1000-kw.	Protein
	Kg/daa	Relative yield	kg	g	%
Domen (2-r)	489	100	74,6	49,0	10,8
Arve (6-r)	602	123	69,2	40,3	9,7
Olsok (6-r)	592	121	69,2	38,3	9,9
Barke (2-r)	505	103	72,5	49,0	10,0
Quench (2-r)	539	110	72,1	48,5	9,3
Tamtam (2-r)	567	116	72,1	49,5	9,3
6 kg N/daa	481	100	71,3	45,5	9,4
8 kg N/daa	511	106	71,3	45,5	9,5
10 kg N/daa	566	118	71,5	45,7	9,7
12 kg N/daa	639	133	72,4	46,4	10,8

% of kernels > 2.5 cm



Malting analysis, 2013

Cultivar	Extract Yield %	Saccharifica-tion Rate, min	Odour mash	Clarity Wort	Colour of wort (EBC)	pH Wort
Domen	78,5	10-15	Normal	Clear	2,7	6,0
Maskin	76,5	15-20	Normal	Clear	2,7	6,0
Varde	78,8	10-15	Normal	Clear	2,7	6,0
Arve	76,8	10-15	Normal	Clear	2,7	6,0
Olsok	77,1	15-20	Normal	Hazy	2,7	5,8
Saana	79,0	10-15	Normal	Clear	2,7	5,8
Barke	79,3	15-20	Normal	Clear	2,7	5,9
Marthe	79,7	15-20	Normal	Clear	2,7	5,8
Quench	82,1	10-15	Normal	Clear	2,7	5,8
Tamtam	78,9	10-15	Normal	Clear	2,7	6,0

* 2014 the same differences between species, in general higher Saccharification rate

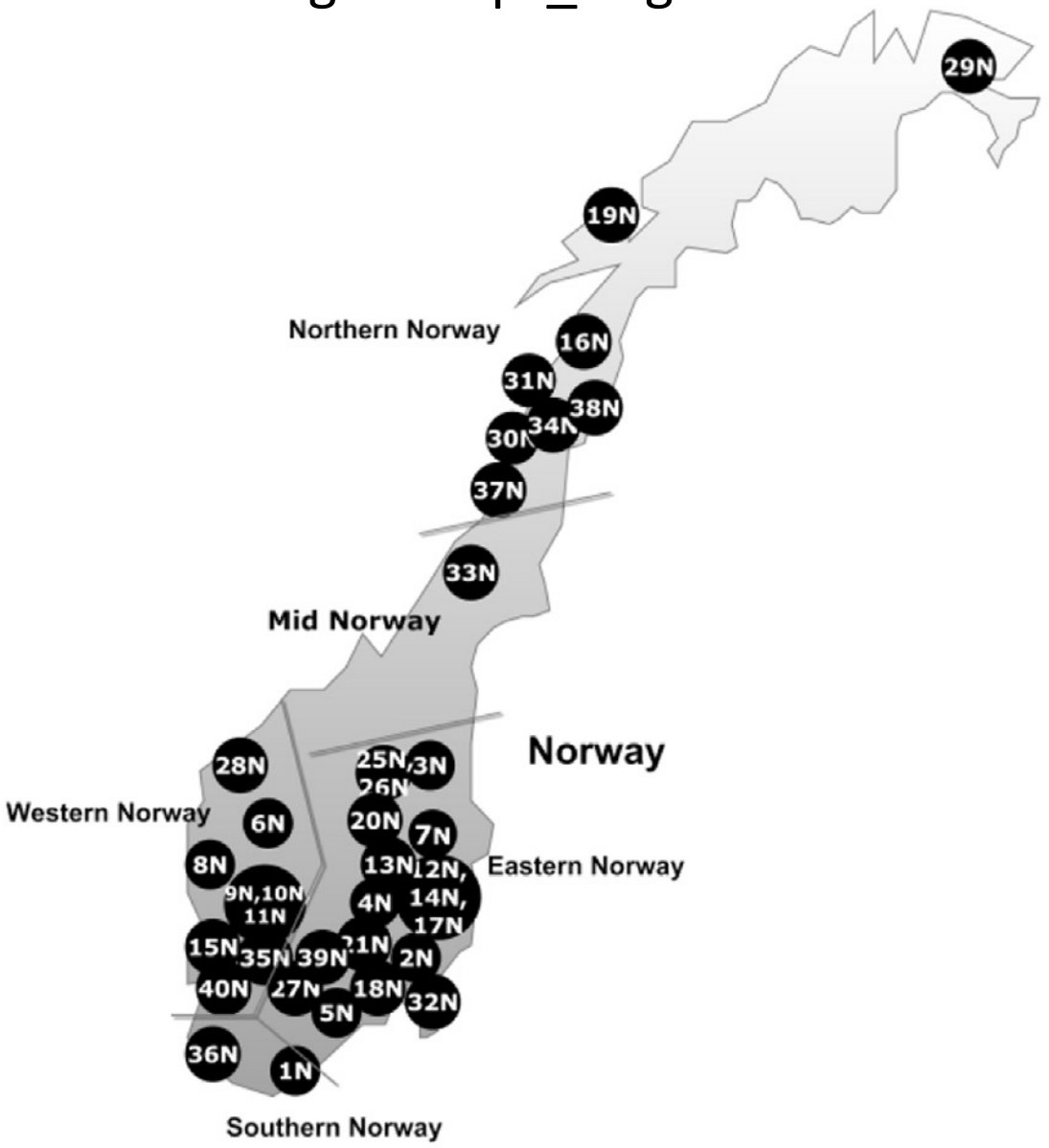
Conclusion

- Large variation between cultivars
- Older cultivars lower yield, Arve, Olsok and Varde highest yield . Domen highest protein, 1000kw - and Hl-weight
- 2- row cultivars larger kernels than 6-row cultivars. Marthe and Quench best of 2-row - and Arve best of 6-row cultivars.
- New cultivars higher extract yield, Quench best malting quality
- Bottlenecks…

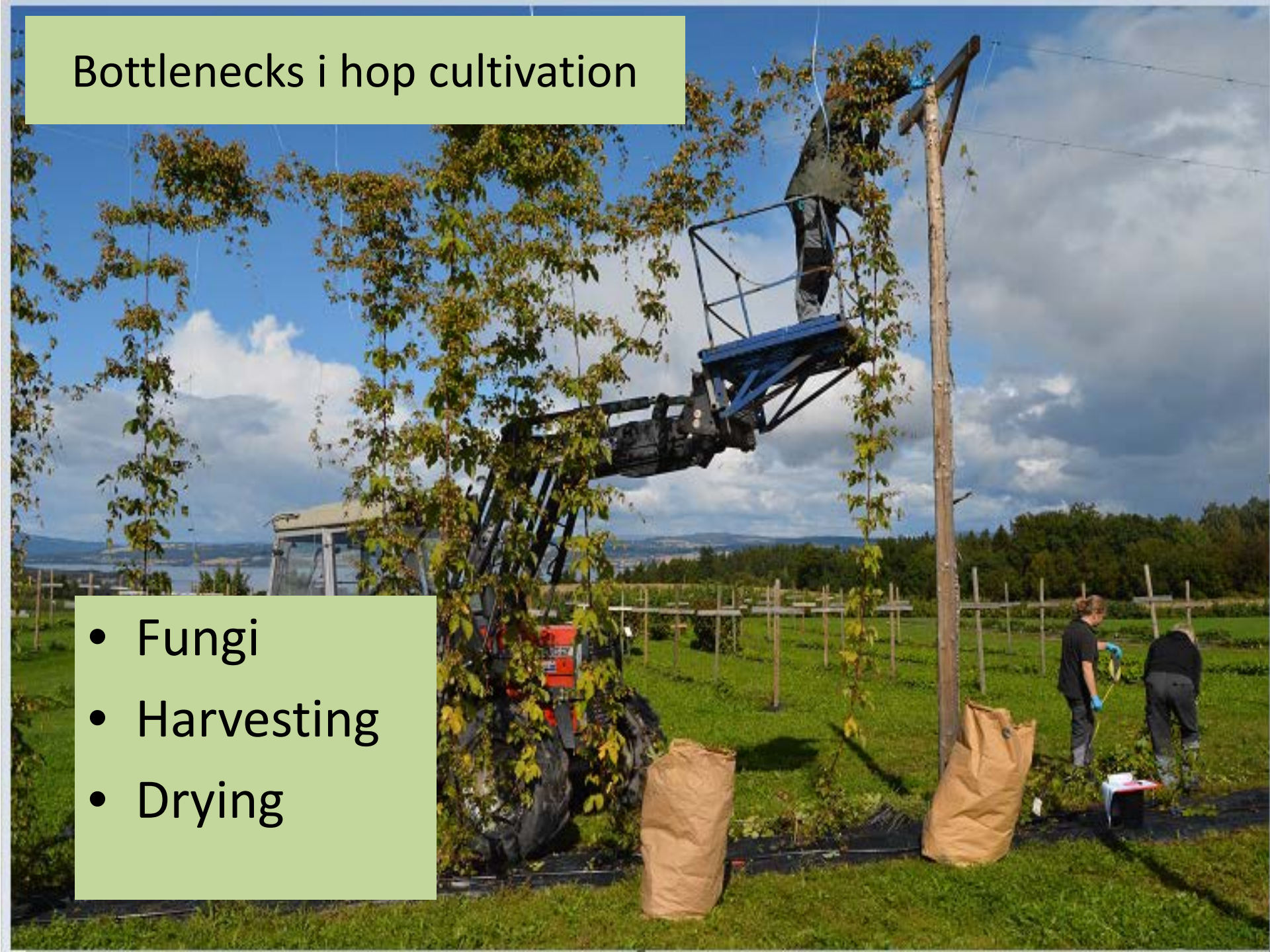
Hops

- Germplasm collection 35 clones
- Selected clones in a north to south gradient and for differences in content of acids and aroma
- Cultivation in tunnel and open field
- Height in open field 5m in tunnel 3,5- 4m; between rows 4 m, 6 runners are trained from each plant.

Germplasm collection of Norwegian hops_origion



Bottlenecks i hop cultivation



- Fungi
- Harvesting
- Drying

Hops yield

	Tunnel		Open field	
Clone	**Dryweight of cones, g per plant**			
	2013	2014	2013	2014
7	0,26	445	0	153
37	1,83	524	0,32	221
40	11,63	857	1,1	367

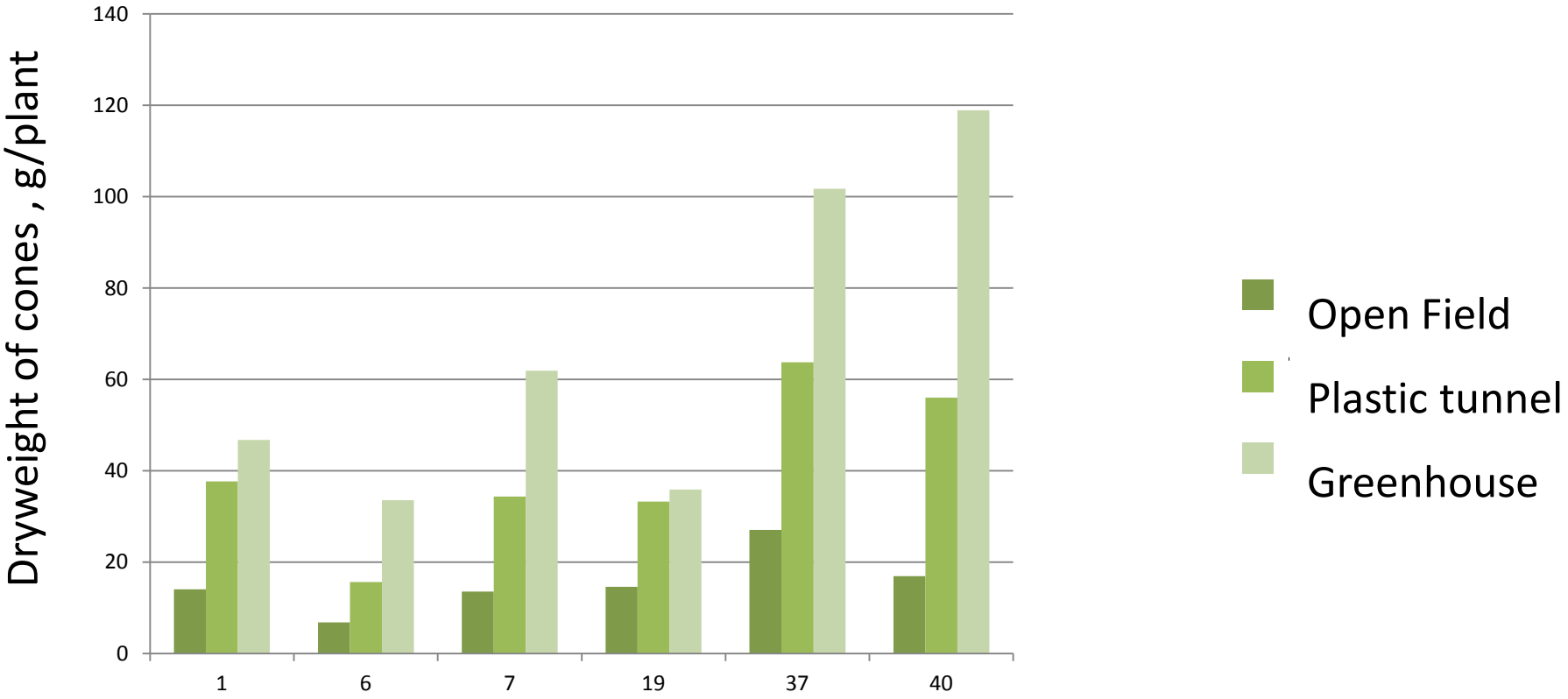
Hops – Chemical analyses 2002

Clone	Alpha acid	Beta acid	Cohumulon	Colupulon	Aromatic oil
Analyzed 2002	**weight %**	**Weight %**	**Rel. %**	**Rel. %**	**ml/100g**
6N	5,7	3,8	22,8	39,5	0,85
7N	7,2	7,2	29,2	47,2	1,35
27N	6,4	4,9	26,6	42,9	1,50
37N	5,6	4,8	23,2	43,8	0,85
40N	4,5	5,3	26,7	47,2	0,70

Hops – Chemical analyses 2014

Clone	Open field / Tunnel	Alpha acid,	Beta acid	Cohumulone	Colupulone
		Weight %	Weight %	Rel %	Rel %
6	Open field	3,97	3,37	24,90	41,97
7	Open field	3,93	5,00	33,80	50,57
27	Open field	3,90	4,40	33,00	45,67
37	Open field	4,40	2,77	24,60	44,33
40	Open field	3,23	5,40	28,97	48,13
7	Tunnel	4,47	5,07	30,77	48,80
37	Tunnel	5,33	3,30	24,67	44,77
40	Tunnel	4,43	5,67	27,77	48,90

Norwegian hops and temperature requirements



Six clones of Norwegian hops grown under different temperature regime, 2014

Herbs:

Rhodioal rosea
Carum carvi
Oreganum vulgaris
Achillea millefolium
Filipendula ulmaria
Calluna vulgaris
Angelica archangelica
Artemisia vulgaris


TELE
EDB

Conclusions

- Hop cultivation in Norway can succeed
- We need more work on selection of clones and testing of cultivars
- Diseases – understanding and preventing
- Herbs offers a large opportunity for creating unique tastes
- Herbs for increased shelf life and other functional effects.

Initiatives

«Nordic Malt House» Initiative 2009

- Malting in Denmark:

- Norway:
- Valdres Gardsbryggeri (NIBIO)
- Smoked malt from «Såinnhus» Celtic *"sorn«*
  (korntørkingsovn)

- Nordic Craft Malt Cooperative
- NMBU, Institutt for kjemi, bioteknologi og matvitenskap

Thank you for your attention!