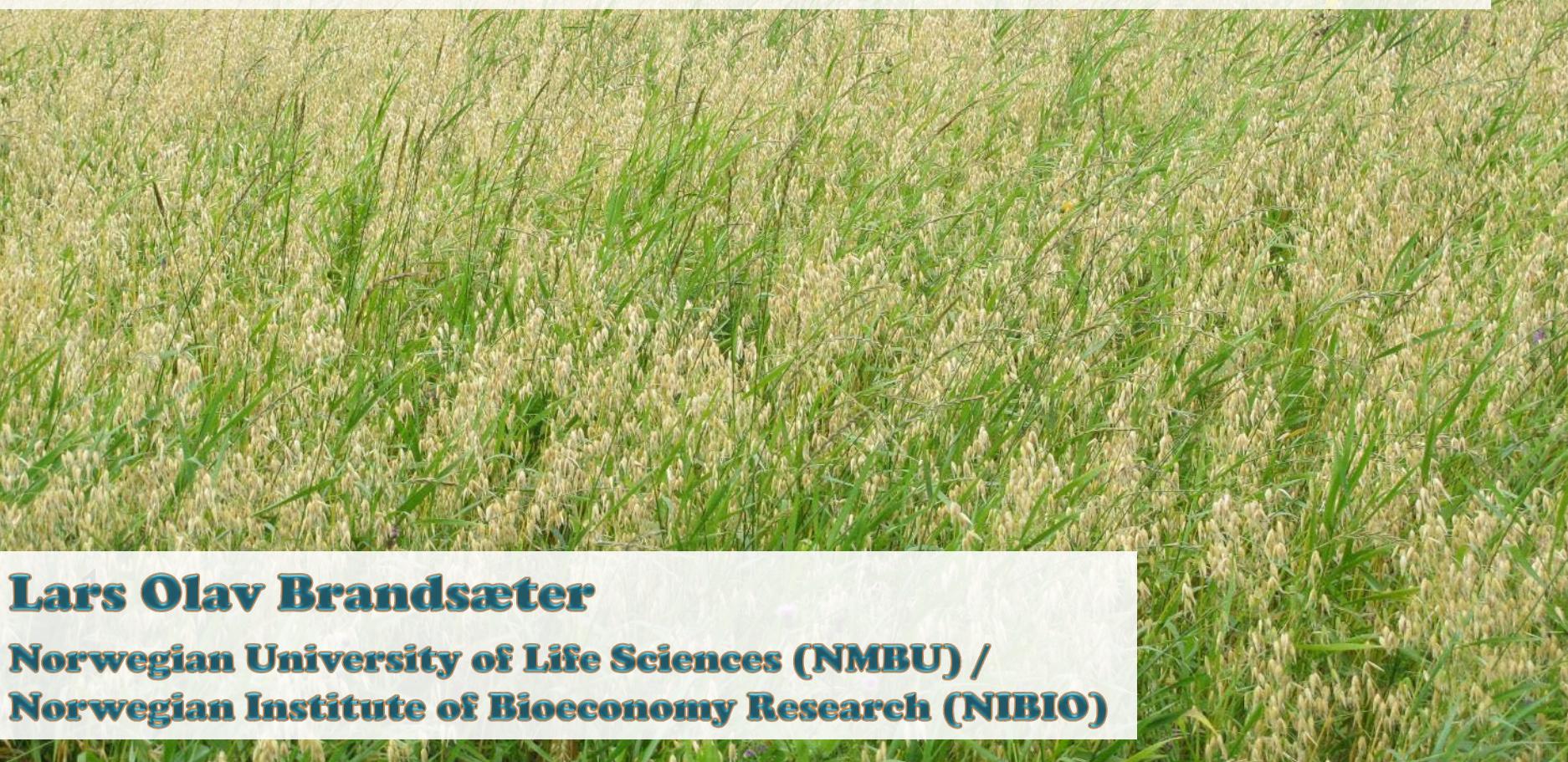


ProAgria (Finnish extension services) - “Couch grass-webinar” for organic farmers.

“Non-chemical controlling of Couch grass* from a Norwegian perspective”

(*and some other creeping perennials)

Wednesday 26th January 2022

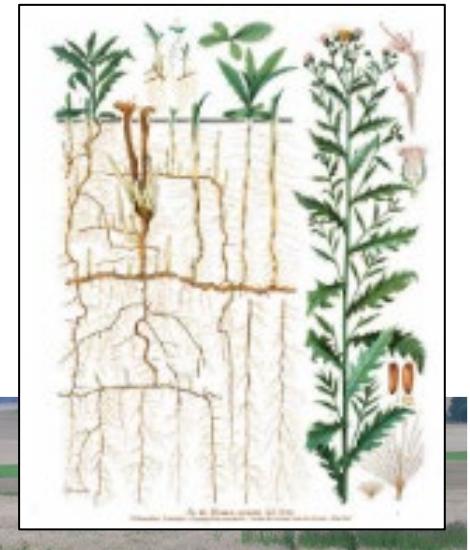
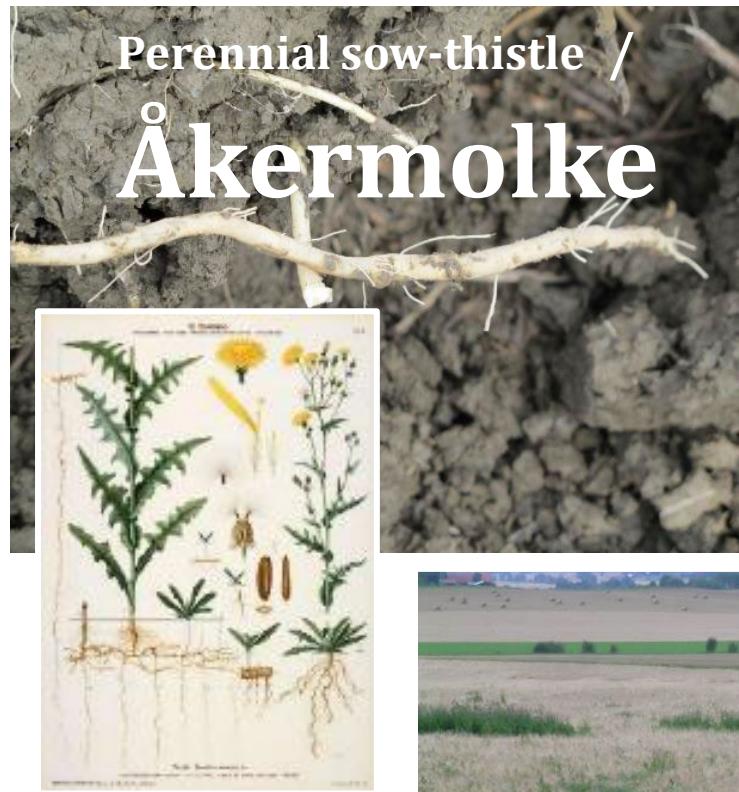


Lars Olav Brandsæter

Norwegian University of Life Sciences (NMBU) /
Norwegian Institute of Bioeconomy Research (NIBIO)



Experimental farm at the University (Ås, Norway):
The soil is described as silty clay* loam
with poor natural drainage (Bakken et al. 2006)
(*clay content 25-35%)



I. Projects / experiments related to ploughing.....



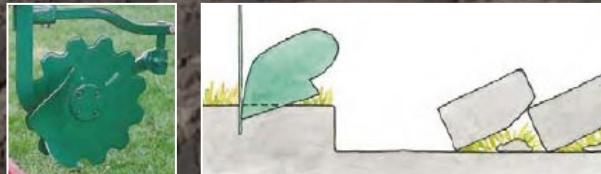
The soil is described as silty clay loam
with poor natural drainage (Bakken et al. 2006)

«Good agronomic practice».....

(One thing is what you do - something else how it is performed)

The importance of an optimal ploughing

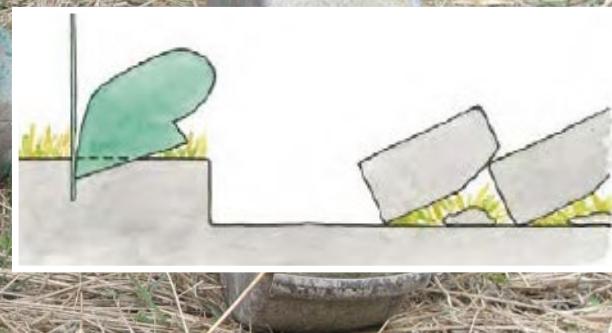
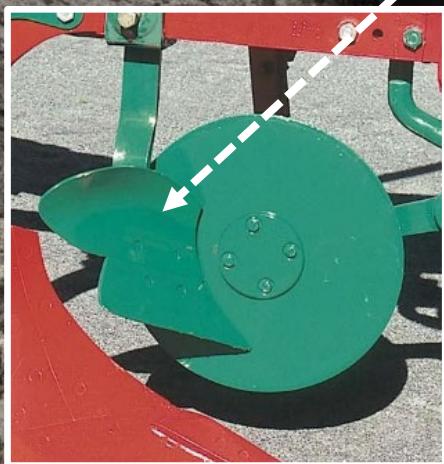
- Plough: In good condition
- Optionals (e.g. skimmers)
- Plough and tractor adapted
- Appropriate setting



After ploughing:
No contact between roots above
and under the ploughing depth



Plough with skimmers (no: forplog)



Couch grass - biomass (relativ results)

	1969	1970	1971	1972	snitt
Plough without skimmers	100	100	100	100	100
Plough with skimmers	94	84	53	63	73.5

(Svensson & Gummesson 1972)

Ploughing depth, deep versus shallow, in spring cereals (25 cm vs. 15 cm, in spring)

25 cm. vs. 15 cm

~ 50%
reduction

~ 80-90%
reduction
(!!!)



Predominant perennial weed species (dry weight, g m^{-2}) in autumn 2006 (after repeating the treatments 3 yr.) as influenced by depth of ploughing in spring*

Location / species	Depth of ploughing	15 cm	25 cm
Location 1 (Apelsvoll) <i>S. arvensis</i>		43.96 a	22.81 b
Location 2 (Kvithamar) <i>E. repens</i>		16.58 a	8.56 b
		30.75 a	2.54 b

*Figures representing different levels of treatment and being assigned different letters are significantly unequal.

(Brandsæter et al. 2011)



Spring

Soil structure and weeds



Timing of ploughing (and stubble cultivation / harrowing)

Factor 1: Soil tillage treatments

1. Ploughing 25 cm
2. Stubble-harrowing (discharrow) + ploughing (25 cm)

Factor 2: Timing

1. Autumn (after crop harvest)
2. Spring

Two sites: Ås (3 years) and Øsaker (2 years)



Treatments:	Couch grass	Creeping thistle	Perennial sow-thistle	All weeds	Cereal
	DW	DW	DW	DW	DW
Ploughing - autumn	100	100	100	100	100
Harrowing and ploughing - autumn	37	90	96	80	120
Ploughing - spring	109	48	44	65	135
Harrowing and ploughing - spring	14	59	41	31	90

(Shoot assessments / DW = shoot dry weight)



(Brandsæter, Mangerud, Helgheim & Berge 2017)

Spring Autumn

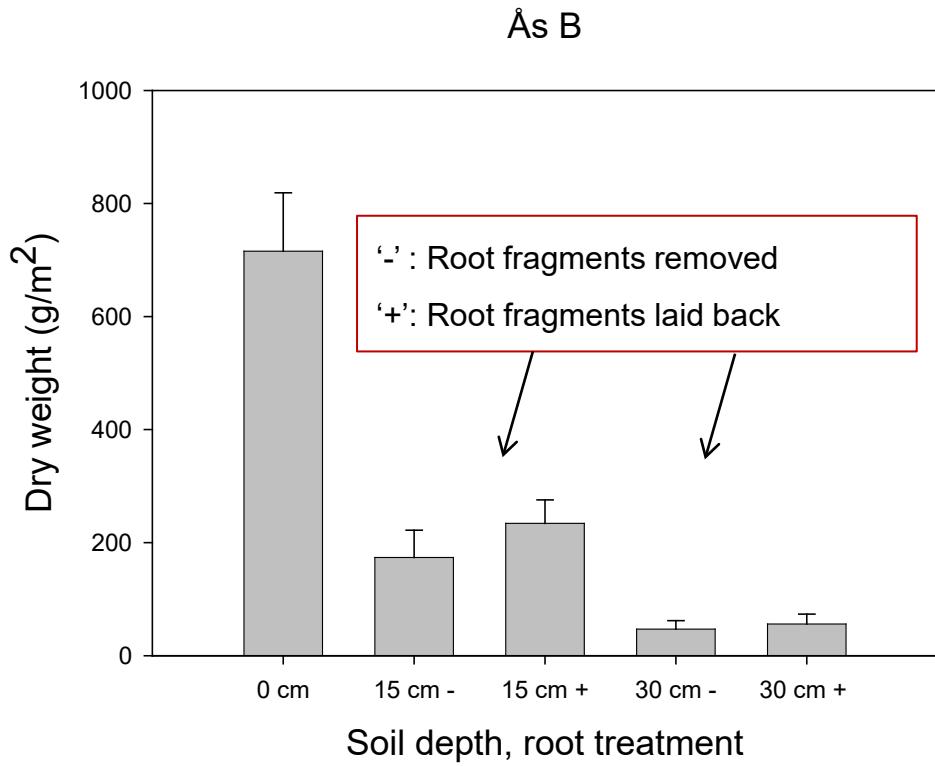
Ploughing.....

- A big hammer: The singel non-chemical treatment with most significant effect on weeds (?)
- The effect of ploughing is highly connected to depth.
- Different weed species respond different to:
 - Depth
 - Timing (autumn vs. spring)

Why this huge effect of ploughing depth on creeping thistle?



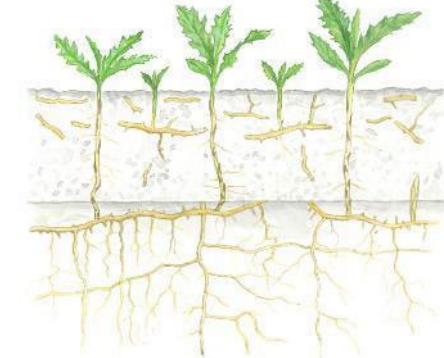
Experiments on shooting dynamic from root parts
at different soil depths (*Cirsium arvense*)



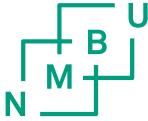
Perennial sow-thistle



Creeping thistle



Creeping thistle (in spring cereals)

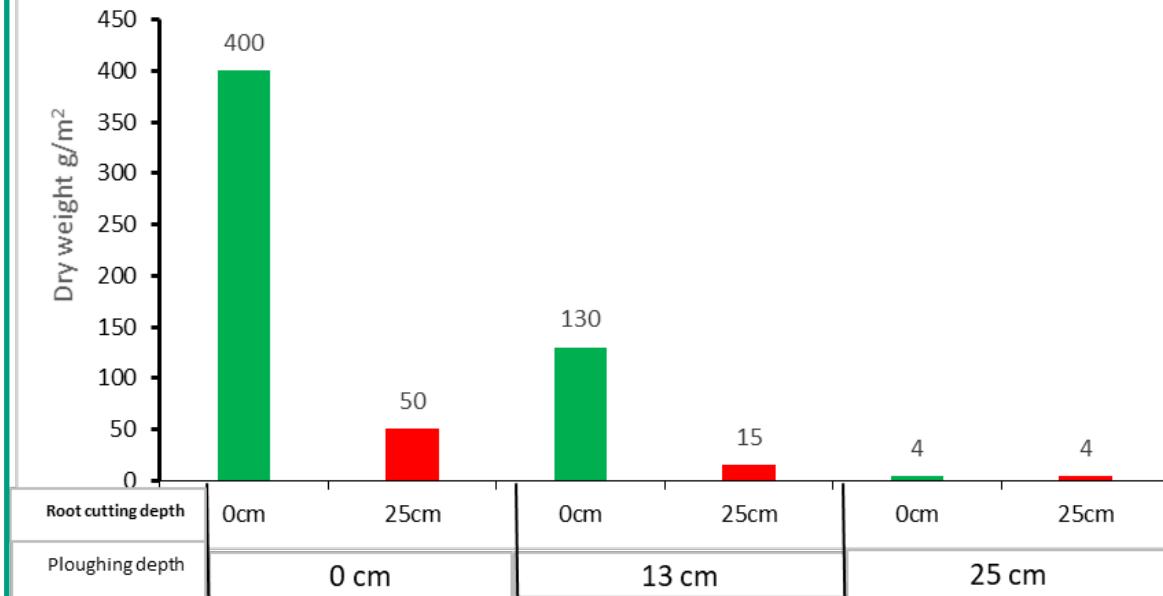


Can «root cutting»
replace the need for
(deep) ploughing?



Foto: L.O. Brandsæter

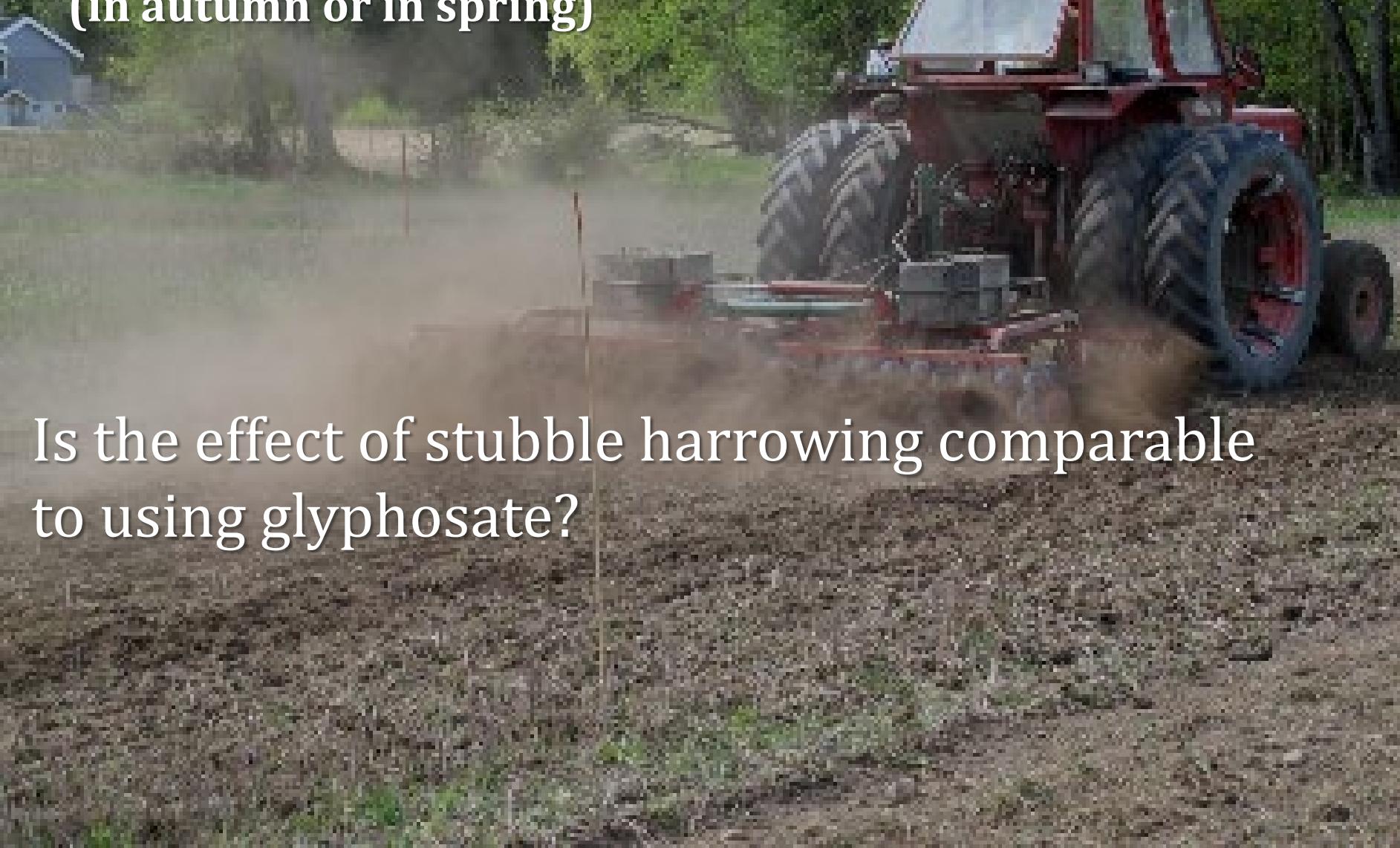
Creeping Thistle (*Cirsium arvense*)



Spring



II. Projects / experiments on stubble cultivation / harrowing (in autumn or in spring)



Is the effect of stubble harrowing comparable
to using glyphosate?

Stubble cultivation (autumn, after harvest)

Relative numbers; Weed biomass

Weed species	Year	Control		Mower		Rotovator		Shallow ploughing + harrowing	
Couch grass	2005	100	a	77	ab	45	ab	14	b
	2006	100	a	37	b	8	b	10	b
Perennial sow-thistle	2005	100	a	29	a	70	a	46	a
	2006	100	a	41	a	93	a	37	a
Creeping thistle	2005	100	a	99	a	27	a	49	a
	2006	100	a	112	a	11	b	24	b



Autumn



Stubble cultivation (e.g. with a disc harrow) in the autumn, control of different weed species:

- **Couch grass ≈50-80% control**
 - Perennial sow-thistle
 - Creeping thistle
- } ≈ 10-50% control (??)



Winter Spring Early summer Mid-summer

Autumn

Winter

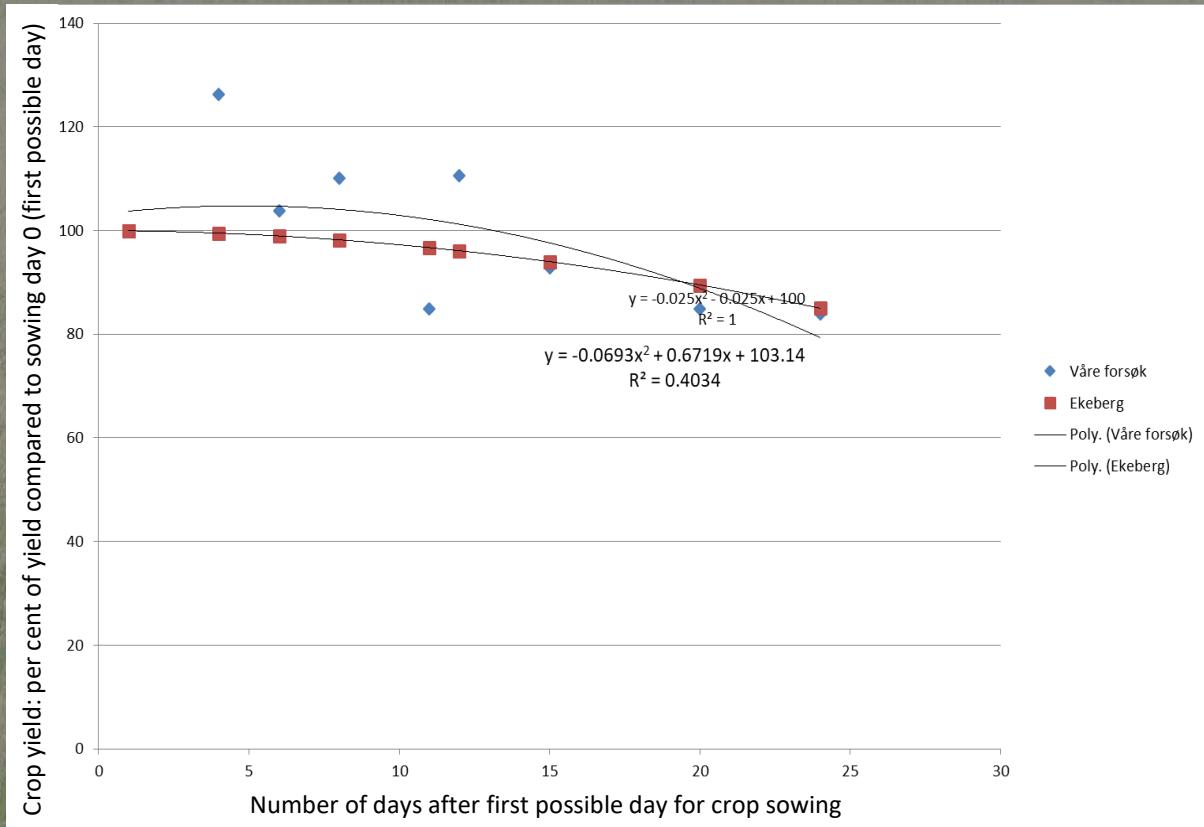
Kvik-Up / KvickFinn - harrows



Will even more aggressive harrows improve the control of creeping perennials?

Harrowing (before sowing spring cereals):

Good effect against couch grass but delayed sowing commonly cause decreased yield.



(Ekeberg 1987 m. fl.)



Spring

«Kverneland Prototype – Horizontal root cutter»



So far we may conclude that it is a positive relation between the harrow aggressiveness and control efficiency of weeds –

Is it then realistic to believe that we can develop new implements that are less aggressive but control weeds satisfactorily?

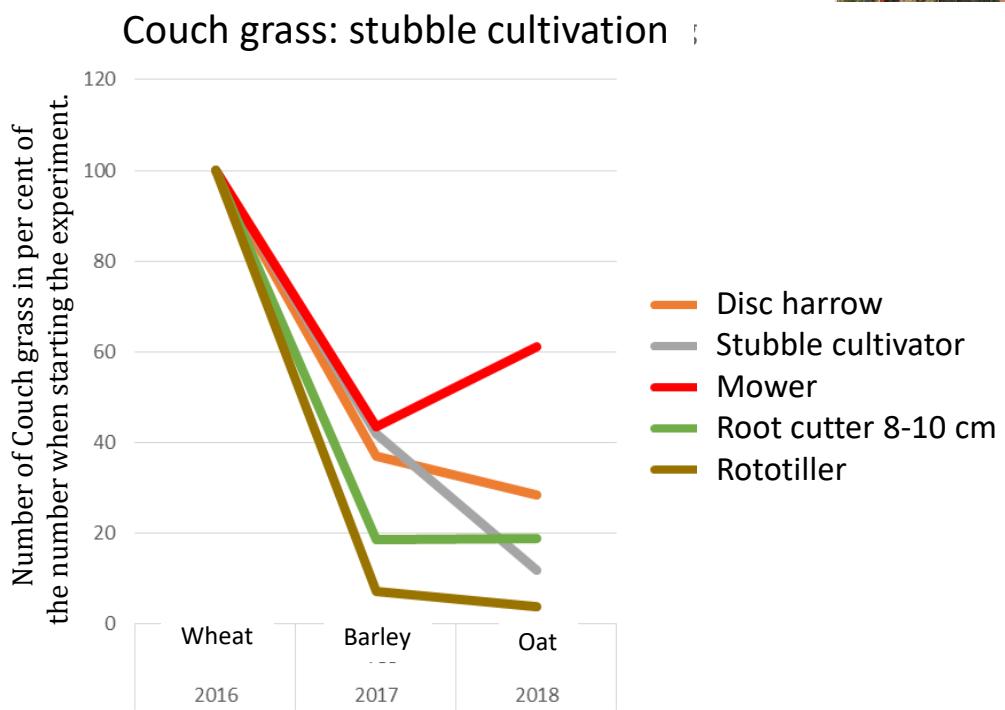


Autumn



Kverneland Root cutter: Last version
(with a 'roller')

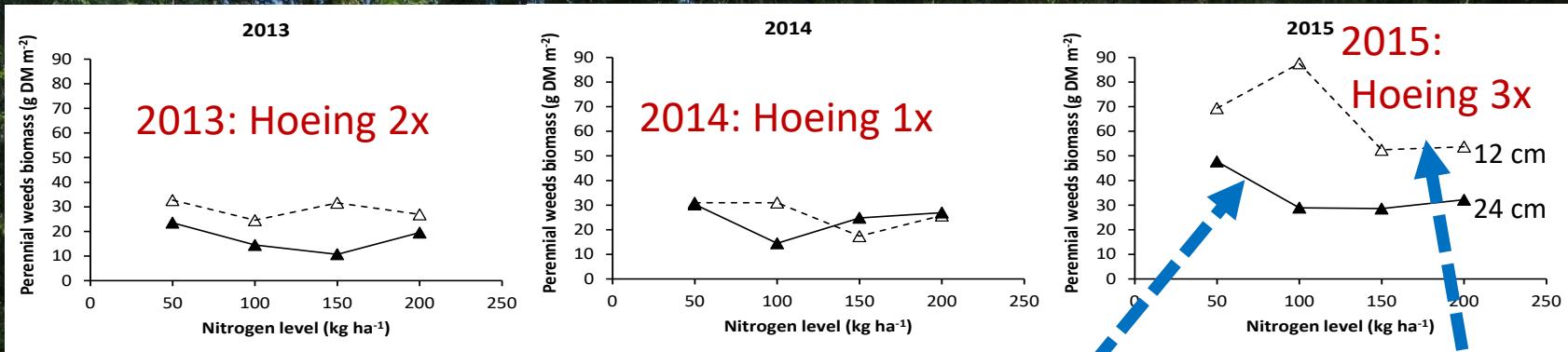
Stubble cultivation by «Kverneland Prototype – Horizontal root cutter»



Autumn

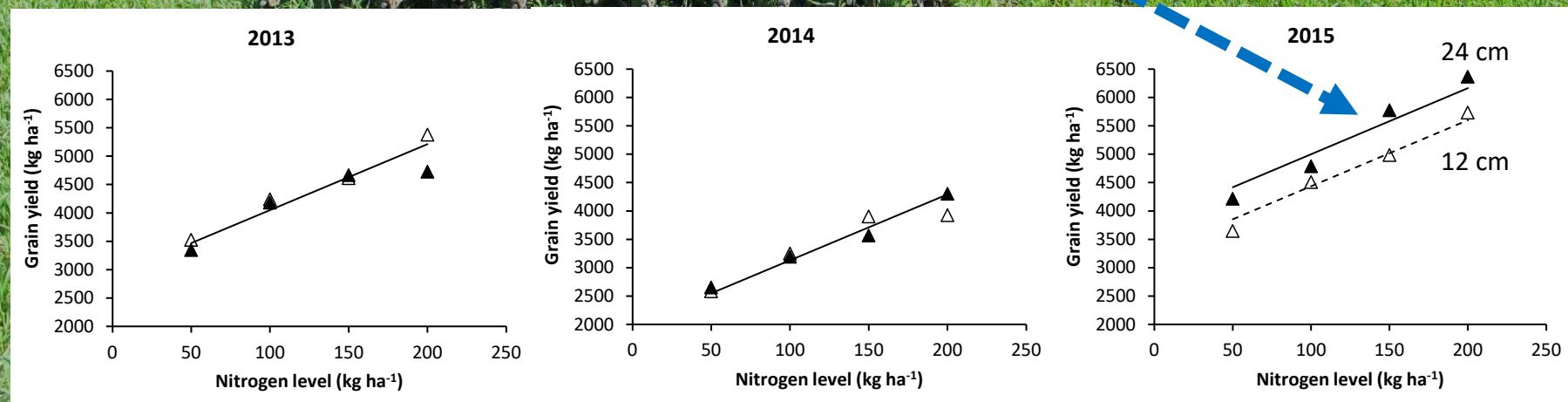
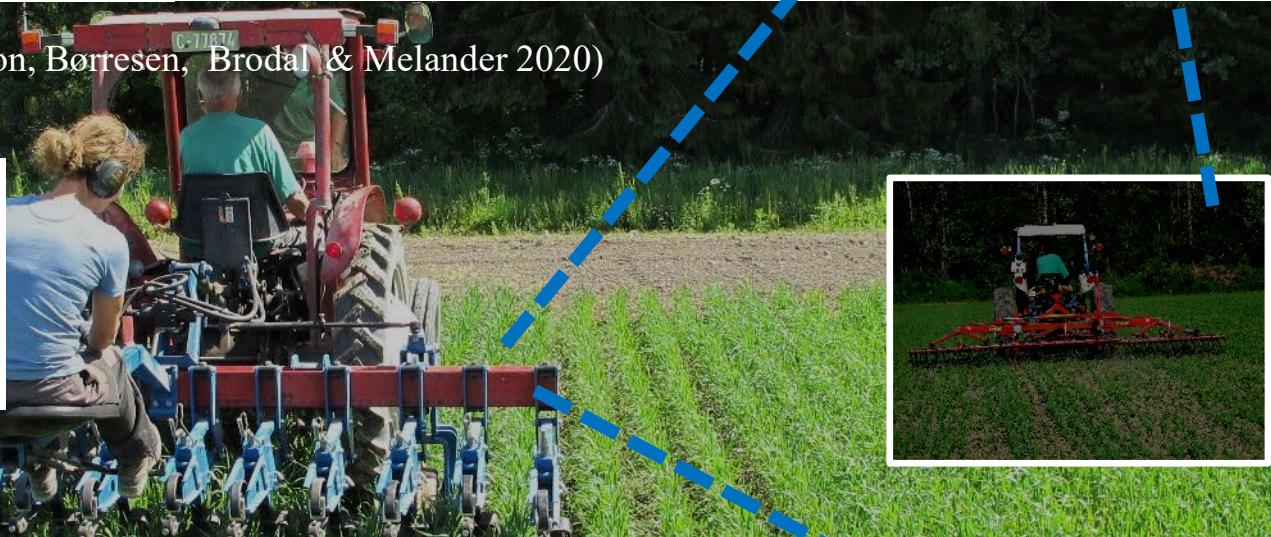
III. Inter-row hoeing (against perennial weeds)





(Brandsæter, Mangerud, Andersson, Børresen, Brodal & Melander 2020)

Hoeing 3 times (in one season) \approx 50% reduction of perennial weed biomass



Direct non-chemical weed measures used in a cereal crop

Inter-row hoeing (perennial weeds)



«Cameleon» from Gothia redskap
Sowmachine, hoer, harrow, fertilizer



Summer

IV «Strategy experiments»

Photo: 22 September 2020

Strategy experiment (3-4 year – same treatment on same plot...)

#	Treatments in spring	Treatments in the crop		Stubble treatment		
1	Normal sowing time		Weed harrowing		Mowing	
2	Normal sowing time		Hoeing		Mowing	
3	Delayed sowing «Kvik-Up»			Weed harrowing		Mowing
4	Delayed sowing «Kvik-Up»			Weed harrowing		«Kvik-Up»
5	Normal sowing time		Hoeing		Disc harrow	
6	Normal sowing time			Weed harrowing + clover	 	Mowing +



Winter

spring

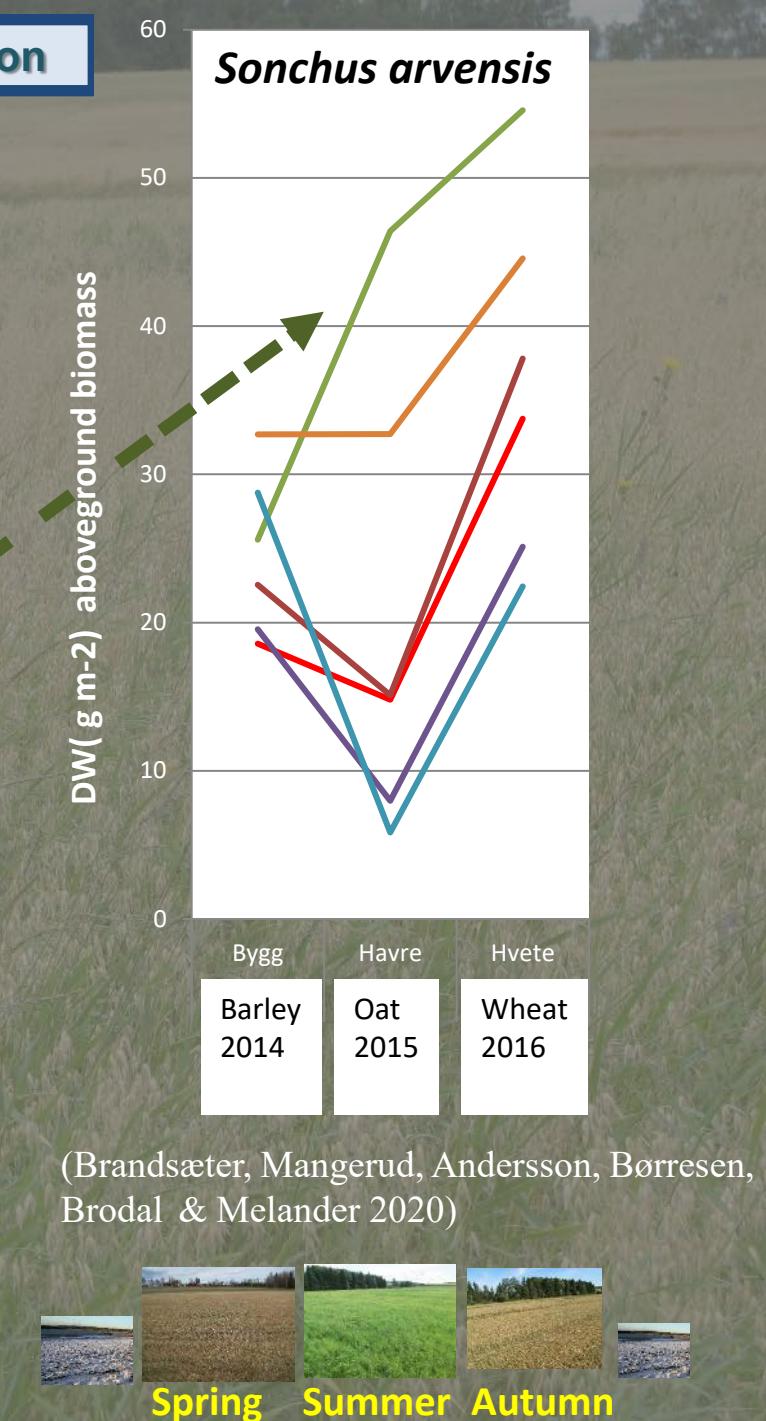
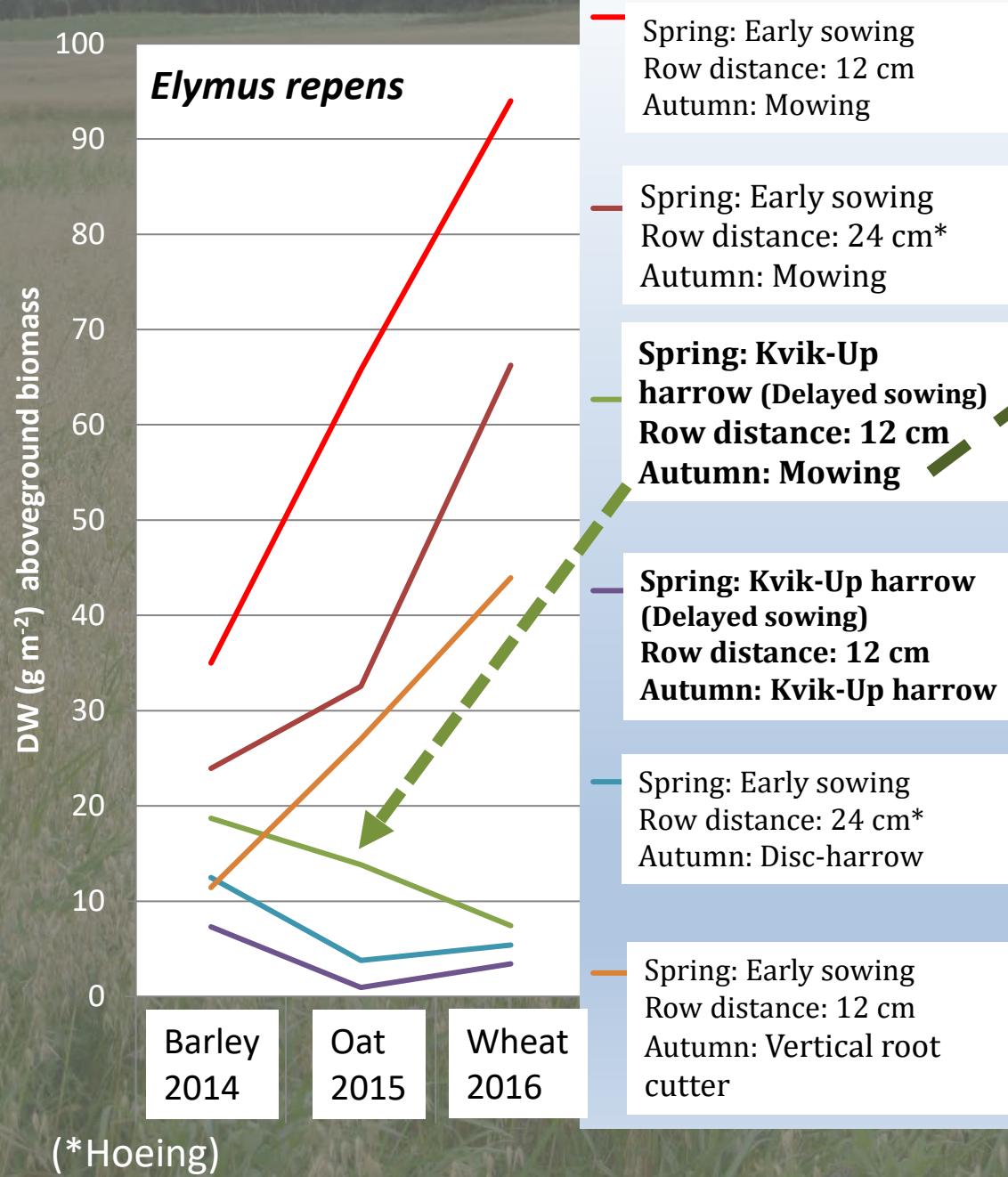
Early summer

Mid-summer

Autumn

Winter

Effects on weed species differ with type of operation



A running experiment: SusCrop ERA-NET (EU) project: “Applying and Combining Disturbance and Competition for an agro-ecological management of creeping perennial weeds” (2019-2022) (Short name: «AC/DC weeds»)

- ❖ Germany
- ❖ France
- ❖ Denmark
- ❖ Finland
- ❖ Norway

❖ Main part of the experiment:

1. Factor Subsidiary crop/cover crop (FI & NO: Ryegrass + clover)
2. Factor: Root cutting (10 cm in the autumn + 25 cm in spring)
3. Factor: Ploughing (in spring, 25 cm)

Plus some additionally treatments in Finland and Norway



- *Factor 1: Subsidiary crop / Cover crop*



- **Factor 2: Root cutting –**

Shallow (≈ 10 cm) in autumn ('stubble treatment')

Deep (20 or 25 cm) in spring



Additional treatments in Finland and Norway

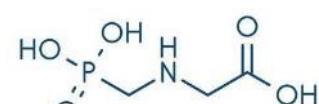
‘KwickFinn’



in the front of the harrow robust goosefoot shears
loosening the soil (ca. 15 cm)

Harrow tines mounted on a rotor driven by tractor PTO (down to 5-7 cm) throws soil and plant materials into air.

+ Norway – a glyphosate treatment:



glyphosate

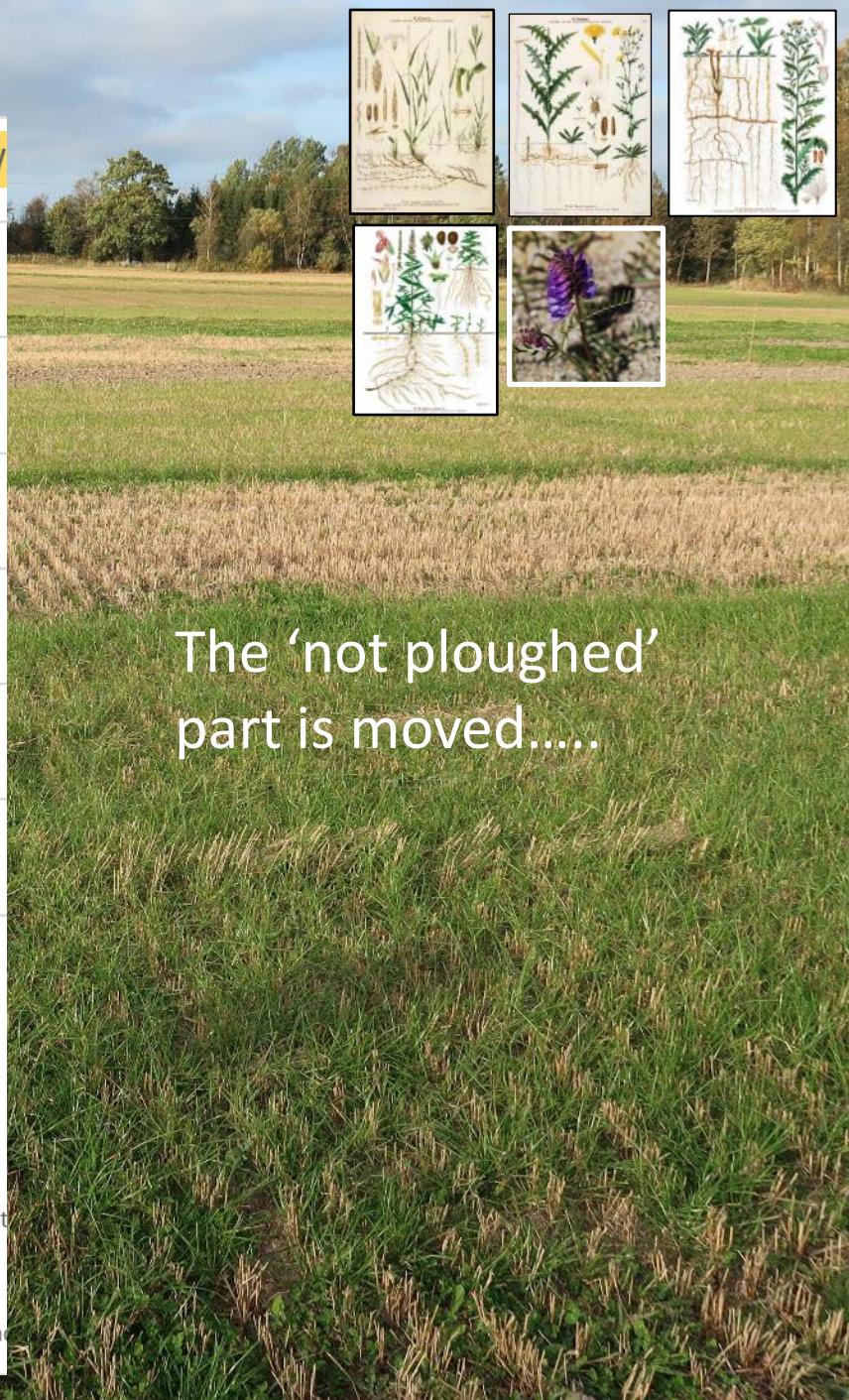
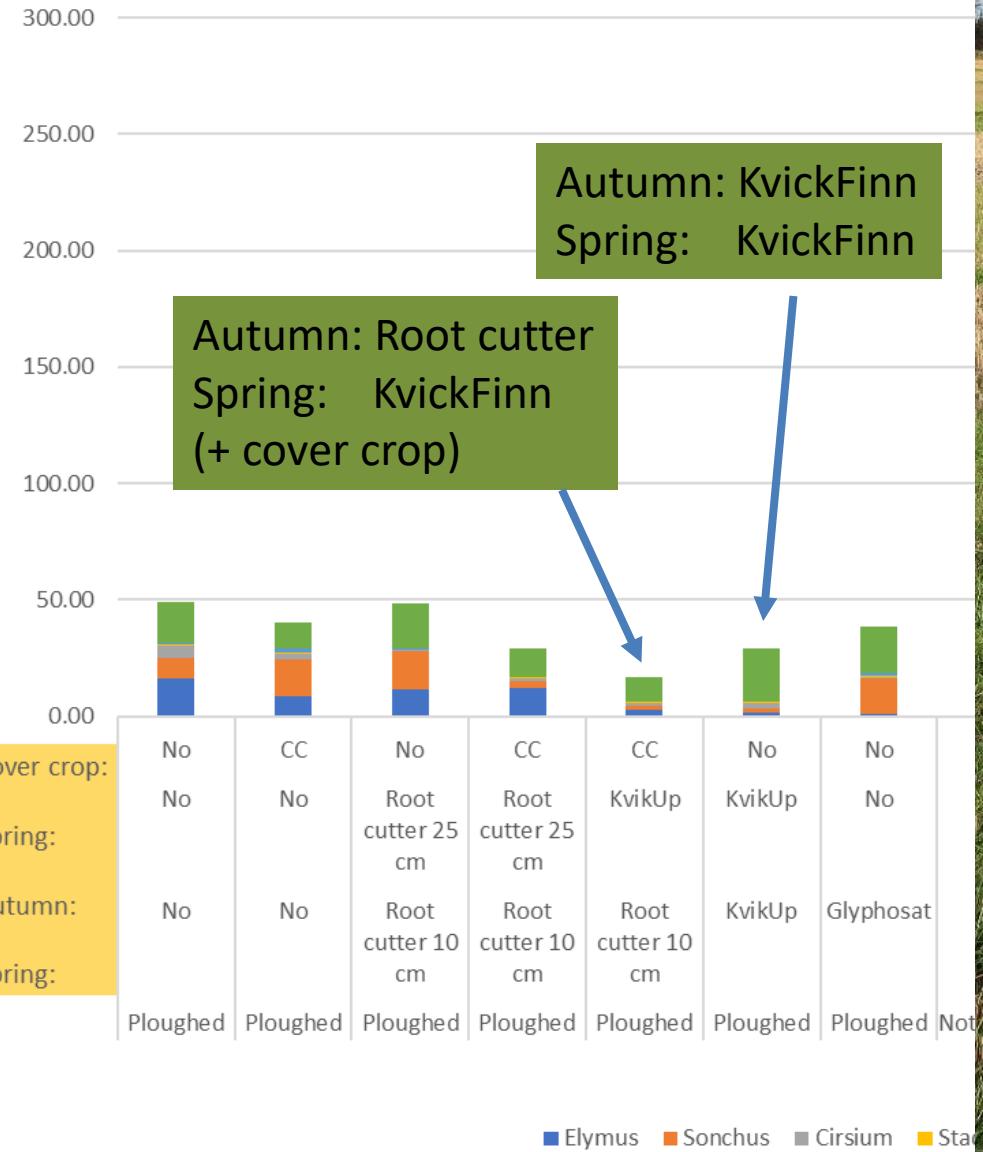


Subsidiary crop
with root cutting

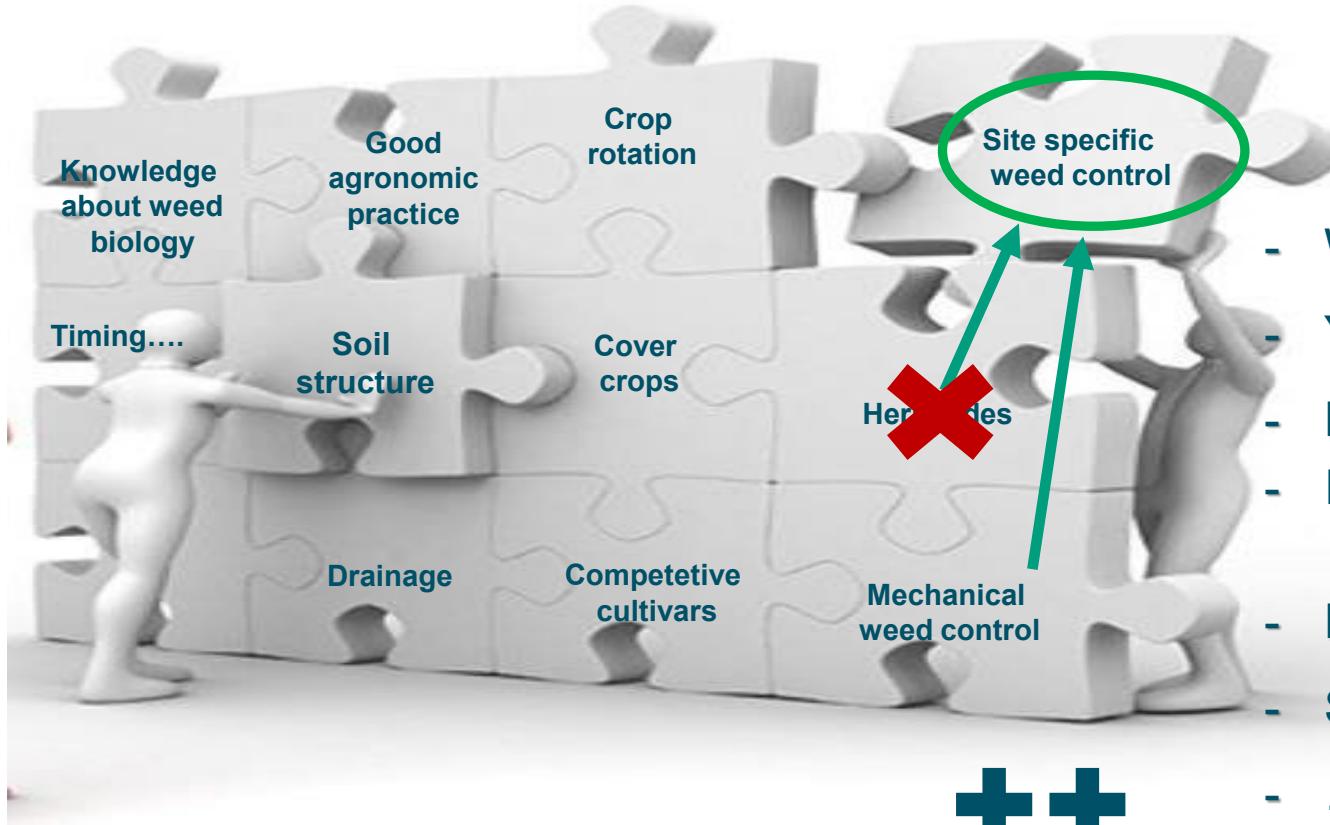
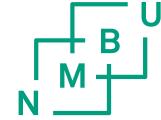
Subsidiary crop
without root cutting

2021

All weeds - Shoot biomass (DW)



- Weed control in IPM and organic



- Weed control efficiency
- Yield
- Economy
- Impact on other biotic and abiotic factors
- Environmental impact
- Social impact
-

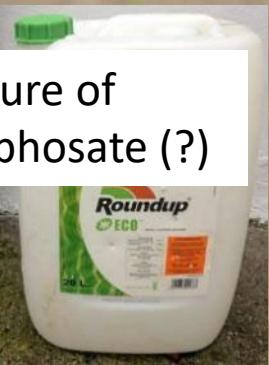


Norwegian University of Life Sciences

Not so easy.....

Paradoxes

Future of
glyphosate (?)



Reduced use of
energy



Stubble harrowing cause
erosion and leaching



Less use of
herbicides

'Not' grassland in
the South-East



Plant cover during
the whole year



Less (no..) ploughing



The weeds....?



Thank you for your attention